RC Tips

Compiled from RC Car Action and other internet sites

Contents

How to be a Better Turn Marshal

Often overlooked and frequently dreaded, turn marshaling is a very important part of racing. Although in a perfect world nobody would ever crash during a race, the reality is that crashing, flipping your car and getting pinned into the wall can happen numerous times during a race, and it is every turn marshal's responsibility to get everyone up and running immediately. As a courtesy to others, and to appease "race karma," it is your job to be the best turn marshal possible, and here are some tips on doing so:

Dress appropriately
Part of being a good turn marshal is dressing the part—not for style—but rather for your own safety. With 8-pounds of steel whizzing around the track at 40+ MPH, it is important to dress with safety in mind, which will not only protect your body, but give you more confidence while doing your job on the track. You should always wear boots, pit gloves, long shelves and sunglasses or goggles. Serious injuries and even deaths have occurred on RC race tracks, so protecting yourself is extremely relevant and important.

Stay low
When manning your area, keep in mind that all of the drivers need to see around you. If you block a driver's view for even a split second, it may cause him to crash or lose his line. It is best to position yourself low to the ground in the "catcher's position." This will limit your obstructiveness and allow you to spring to action quickly if needed.

Watch your corner, not the race
Although turn marshal is essentially the best seat in the house, don't lose sight of your job; you are not a spectator. While it is good to stay aware of the race in general, your focus should be on your section, not on the leader and the rest of the field. If you get "into the race," you may miss a crash in your section and waste drivers' valuable time because you were more interested in watching the race.

Communicate with other Marshals
Most of the time, your section of the track will be pretty clear-cut and defined. You will know exactly what constitutes your area and what sections you are responsible for. Sometimes, however, there is some grey area that exists. It is a good idea to communicate with your neighboring marshals and decide who will cover which "in-between" areas of the track.

Prioritize pile-ups
Most of the time crashes aren't isolated; cars usually end-up in collisions and pile-ups with one another. While you should do your best to get everyone running as quickly as possible, try to get the first cars involved in the collision up and running first. Races are won and lost in seconds, so time is of the essence.

Give drivers a good line
When you place a rescued vehicle onto the track, be mindful and give the racer a good line. Although the crash may have been their own fault, your job as a turn marshal is to minimize the

impact of a driver's accident on the race. When correcting a vehicle, think like a racer, and angle the car for the best line possible.

Pull disabled cars off quickly

Often times, a crash may be critical, and cars become partially broken, flamed-out, or completely out of commission. When you can tell a car is disabled, it is important to get it off of the track. You need to quickly assess if it would be possible for the driver's pit crew to get up and running. If you think the car is too far gone, put it in a safe place in the back if your corner, but if you think it is fixable or a simple flame-out, try to meet the pit guy half-way, and hand it off on the track.

Turn marshalling isn't the most glorious job in the world, and usually racers scoff over having to spend valuable pit time by performing their duties, but in reality, turn marshalling is an extremely important job. Although you may not see a benefit in being a better turn marshal, what goes around comes around, and the better racer you become, the more that will be expected of you in all aspects of racing—turn marshalling included.

How to be a Better Racer in 3 Easy Steps

1. Slow Down: The number one reason I see people going slow around a track (i.e. not winning) is that they're trying to go too fast. Slow down! Don't drive beyond your ability *or* the car's. This is incredibly important in the corners. Slow down by either using the brakes or coasting into the corners. More than half the drivers at a club race overshoot turns. Don't go sliding into turns. This kills momentum. High average speeds equal low lap times and consistently low lap times win races. I have yet to see a trophy handed out for highest top speed reached before flying over the pipe. Do like real race car drivers do and brake while going straight and apply increasing power throughout the turn. Slow down before you get to the corner.

2. Practice Smart: Turning lap after lap will make you better–eventually. Practice is almost always a good thing and more practice is almost always better. There is a difference, however, between practicing and practicing smartly. Step one to smart practice is having a friend video tape one of your races. Have him focus on just your car. Watch the video and actually study it. Look for every mistake you make. Did you go wide in certain corners on almost every lap. Are there certain parts of the track you crashed on over and over? Was there a certain part of the track that you consistently got passed on? Now when you go practice, focus on those areas and keep practicing in those areas until you fix the problems you found.

3. Set Goals: When you ask most racers what their goal is they may say it's to have fun and we applaud that, but when you dig deeper almost everyone admits the goal is to win. That makes sense; it is a race afterall. Now if you were running your first marathon, your goal would most likely to be to just finish. That's what we call a realistic goal. If you're in the B-main or bringing up the back of the pack of the A, you're realistic goal should be to just be faster than your last run. Forget about your finishing position. After you corner marshal, go check out the print out of the timing and scoring sheet and look at your overall lap total and time, your average lap and your fastest lap. Obviously, you want your overall time to improve, but your average lap time should be your main goal. That's what you really want to improve. You also want to get that as close as possible to your fastest lap–that's the sign of a good driver.

When Should I Move Up to the Next Class?

Moving up in classes can sometimes be a hard thing to judge. Advancing depends mostly on your driving and wrenching skills but may also you may also have to take into consideration your competition or if you are moving from novice to intermediate or intermediate to expert. I will brush on both areas.

I wish to make this guide as universal as possible but factors may vary between electric and nitro racing as well as on and off-road racing.

As I have mentioned in many of my posts, consistency is key. This is also the biggest factor when deciding to move up in classes. When you watch an expert race, the majority of the drivers will crash once if at all during a race. A typical novice driver may crash once per lap. I think you may be catching on to where I'm going with this but i want to get a little more into depth with the topic.

Most racers start in "novice" or "beginner" classes. On a club racing level this is usually people whom are very new to the hobby and often, young kids. This class gives racers a chance to let their nerves settle a bit in a race environment and most importantly, learn the rules and format of racing.

When is it time to move up to the intermediate level?

This is usually the easiest transition among racers, as they get accustomed to completing laps without crashing. Here are a few guidelines to let you know when its time to move up:

- Complete 50-60% of your laps in a heat race without needing to be turn marshalled.
- Win 3 races.
- Your final qualifying time would put you in the top 5 of the next class up.
- Finish multiple consecutive races without breaking

Should I move up to expert classes?

The move to expert classes is a big jump. Many racers aspire to reach this level and some never do. Some racers jump to this level prematurely and don't find themselves having as much fun racing. Either way, here are some guidelines to follow if you are debating on stepping up with the big boys:

- Finish the majority of your qualifiers with 2 or less crashes.
- Your fast laps are within 5% of the fastest guys on the track (usually 1-3 seconds for off-road and much less for on-road).
- Mechanic error resulting in DNF should become extremely rare.
- Consistently finish in the top 3 in intermediate classes

The final thing to take into consideration is why you race. If you just enjoy running on the track in a mildly competitive nature, intermediate classes are the probably the highest you need to be.

If you are very competitive and strive to be the best then your goal is likely to run expert. Most importantly, racing should be fun for you and the others around you.

10 Racing & Setup Tips

1. Neutral Setup: The best place to start with your setup is with what is outlined in your manual. Go with the box-stock settings and install the popular tires at your track. Tires are the single most important aspect of setup–everything else is just fine tuning. When you do start making changes, make one at a time and see how it changes your vehicle. Keep in mind that many adjustments will hardly be noticeable to the average guy like you and me. What you should be trying to achieve is a neutral setup–not too much steering and not too little steering. You want a vehicle that steers but isn't likely to spin out every time you touch the steering wheel. As you get used to the track layout and your car, slowly make your setup more aggressive.

2. Benchmarks: Too many racers worry about where they finish, even in qualifiers. All you should worry about is improving over your last effort. After your race, look at your lap times. Since consistent racers are fast racers, you should concentrate on improving your average lap times. When your average lap times get closer to your fastest lap time, everything else will fall in place.

3. Pass With Class: Drive your car as if it was a real car and you'll be much faster. When you approach a slower car, plan your pass. You'll both be slower if you smash right into the car in front of you. In qualifying, slower cars should yield to faster cars, but that doesn't mean they have to pull over and stop racing so you can fly by. Plan your pass and be patient. The exit of corners is usually a good place to pass because slower drivers often overshoot corners and go wide.

4. Stay Late: The majority of people get to the track early to practice, but the best time to practice is actually after racing is over and the track is in condition you race on. When you get to the track early, it is often dry if it's off-road or dirty if it's on-road.

5. The Night Before: Being prepared is essential to being fast. Go through all your race gear the night before race day. Not only will you be less likely to forget something, but you will find problems when it will be easier to fix them.

6. Bring a Buddy Racing: To experienced racers, most of this will be common sense. They should, however, keep two thing in mind. First, common sense isn't too common. That's an old saying for a reason. Second, common sense seems to get thrown out the proverbial window when competition starts heating up. One of the best way to get us all using our common sense again is to bring a buddy racing with us. This is because we often practice what we preach when we know someone is watching.

7. Practice fast, Race Slow: This is one of our favorite racing maxims at *RC Car Action*. Go a bit faster than you think you can in practice to find your limits. You'll build some skill when nothing is on the line and get a good idea what you and your vehicle can do. When you're racing, slow down a bit and concentrate on being consistent. The fast guys are smooth and consistent. The slow guys are just driving as fast as possible from one crash to the next crash.

8. Take Corners, Don't Overshoot Them: This is how you execute a corner properly: approach the corner and move to the outside and slow down well before the corner, start turning to the inside before you get to the corner, drive along the inside of the corner and start accelerating and then continue to accelerate of out of the corner. Sounds simple, but many racers fly into corners, grab a lot of brake, slide or push to the outside, basically come to a stop and have to accelerate hard out of the corner. This might look fast since they go flying and and accelerate wildly out of the corner, but it is actually the slow way around a track.

9. Walk the Track: Don't trust your perspective from the drivers' stand. Walk the track. Look for imperfections that will trip your vehicle up and study face of the jumps to see where you should be lining up for smooth launches.

10. Have Fun: Having fun is really all about having the right attitude. Having the right attitude will also help you go faster. How so? Well, when you focus too much on beating the next guy or retaking a position you just lost or making up time after a crash, you often try too hard and end up falling back or crashing more.

Bonus Tip: When your vehicle is spinning out and you're sure you have the right tires for your track, try a gearing change before tweaking the suspension. Install a larger pinion. This will smooth out your acceleration and make it less likely for your vehicle to break traction.

Tuning Tips

Although every vehicle can have different tuning characteristics, this list can be used as a generalized guide for off-road vehicles.

Need more steering?

- Batteries- Move the battery towards the front of the vehicle
- Front Shock Mounting- Move the lower shock mount towards the outside
- Front Camber Link- Longer camber links increase steering
- Front Ride Height- Lower the front ride height
- Rear Ride Height- Raise rear ride height for more high speed steering
- Rear Shock Mounting- Move upper mount towards the outside
- Rear Toe-in- Decrease rear toe-in

Need more traction?

- Batteries- Move the batteries towards the rear of the vehicle
- Rear Ride Height- Lower rear ride height
- Rear Camber- Less camber (0-1 deg.)
- Rear Shock Mounting- Move upper mounts toward the inside
- Rear Toe-in- Increase rear toe-in
- Slipper- Loosen slipper so wheels don't spin as much

Need better jumping?

- Shock Oil- If bouncing too much or bottoms out over jumps, use heavier oil
- Shock Pistons- If bottoms out over jumps, use smaller pistons
- Rear Shock Mounting- If bottoms out over jumps, move upper mount towards the outside
- Battery Position- If nose high during jumps, move battery forward, move rearward if nose is down during jumps
- Weight- add weight to nose if it's too high during jumps

Need more high speed steering?

- Front Toe- More toe-in gives you more steering coming out of the corners
- Front Caster- Less caster gives you more steering exiting corners
- Rear Ride Height- Raise rear ride height for more high speed steering

Need more stability over rough tracks?

- Anti-squat- Less anti-squat allows better acceleration on rough tracks
- Rear Camber- More negative camber is more stable on bumpy tracks
- Rear Camber Link- Shorter camber links are more stable on bumpy tracks
- Front Shock Mounting- Move lower shock mount inside for bumpy tracks
- Battery Mounting- Place in the middle for most stability on all tracks

7 Ways to Go Faster (Electric Edition)

One of the most popular subjects in RC is speed. Experienced hobbyists love to point how the only two questions the uninitiated have when they see an RC running are: how fast and how much? Going fast isn't just on the mind of newbs. Truth be told, we're all interested in going faster. Racers quickly point out that it's not how fast your car is that matters, what matters is how fast you get around the track. I know I'm guilty as charged, but if racers actually believed what they say, they wouldn't be buying latest motors, speed controls and batteries every time something hot hit the shelves. Bashers, in contrast, readily admit they have a need for speed. The bottom line is that we're all a little obsessed with speed, and more specifically, going faster. Check out these five top ways for going for faster with your electric ride.

Gearing
Changing to a larger pinion will make your car faster. Most people learn that pretty quick and odds are you already knew that. A larger pinion will also make your electronics run hotter–specifically your motor and speed control. You'll also lose runtime and acceleration. Pinions aren't the only gears that can be changed on most RC cars. It's often easy to swap out a spur gear. You'll need to go smaller for more speed and it's worth noting that the results will be far less noticeable per tooth count change. You can probably expect to gain 2mph from a single tooth pinion increase in most applications.

Increase Motor Timing
Increasing motor timing will increase rpm which in turn will result in more speed. Timing increases on brushless motors tend to yield more subtle results compared to brushed motors, but you will see positive results in both cases. You'll have to watch your motor temperature and make sure it stays below 160 degrees F.

Taller Tires
Changing tire size is like changing gearing. Taller tires cover more ground per revolution, so your car will be faster at the same motor rpm as it was with shorter tires. Off-road, the results will subtle–unless you go to a really huge tire. When racing on-road, specifically with foam tires, this is an important part of race tuning. A half inch increase (pretty significant) tire diameter will yield approximately an increase of about 4 or 5mph.

Higher Kv or Lower Turn Motor
This is the old fashion way to get more speed–add horsepower. Most brushless motors have Kv rating and the higher the Kv rating, the more rpm a motor will put out per volt. If the Kv rating isn't listed, a turn rating will often be used. With brushed and brushless motors, a lower turn rating equals more rpm. Always check the limits of your speed control before installing a "hotter" motor. Increasing your motor's Kv rating 2,200Kv can yield an increase of 20mph if you are using the same brand and model motor and have batteries that can supply the needed juice.

Aerodynamic Body
If you're only going 25mph, aerodynamics aren't going to play too noticeable of a role. If you're going 50mph, aerodynamics will certainly start becoming influential on top speed. In addition to

mounting a low profile, sleek body shell, mount it as low as possible and keep the wheel wells as small as possible. Open up the rear of the body to let trapped air to escape.

Higher Voltage Battery
Want to see some serious speed gains? Go from a 2S (2-cell) LiPo to a 3S (3-cell) LiPo. This jump from 7.4 volts to 11.1 volts can increase speed by as much as 25mph! Make sure your speed control can handle the extra voltage or the only thing you'll be fast is going to the hobby shop for a new speed control. You'll also want to make sure your chassis can accomodate the the larger pack.

Better Grip Tires
All the extra power won't do you much good if you can put the power to the ground and put it to use. Invest in some high-quality aftermarket tires in a soft compound and you'll be going faster.

Speed Secrets of the Pros

What the fast guys are doing

Why are the fast guys so fast? Once you get past the erroneous notion that everyone who's faster around the track simply has faster stuff, you'll probably decide the difference must be natural ability. Sure, a lot of it has to do with reflexes, hand-eye coordination, depth perception, etc. Reality check time. Just as much, if not more, of the fast guys' success has to do with what's going on in their heads. Strategy and mindset are a huge part of racing, both for RC and full-size. Incorporate the following tips into your racing routine and you'll soon be one of the fast guys.

1. Don't overshoot turns: This is one of the most common mistakes we see racers making. Flying into a corner, letting off the gas and washing out way wide scrubs off substantial speed and is a total momentum killer. Slapping your ride off the outside barrier makes it that much worse. Sometimes wide is the fast line around a corner, but you need to make sure you slow down enough before the corner so that you maintain the exact line you wanted to take. If your vehicle isn't doing exactly what you want it to do and you aren't in total precise control, you're going too fast. If you slow down properly before a corner, you will be able to accelerate through the corner and be going faster for a longer portion of the following straight than the guy flies in deep and has to accelerate from almost a stop in every corner.

2. Don't take unnecessary chances: Double and triple jumps give you options. It's simple; you can take a set of doubles as single jumps or jump the gap and land on the downside of the second. The same goes for triples. You can single-single-single, double-single or single-double. You might even be able to sky over a triple as one big jump. Here's the key: know your limits, Knievel. During practice, time how faster you are through a section when flying over, say, a wide double compared to taking it as a single-single. The reality is that you'll probably only pick up a couple tenths of a second. In contrast, crashing will cost you multiple seconds. So, never take a big jump unless you can clear it 100% of the time.

3. Don't make the same mistake more than twice: Tracks change throughout the day, and often sections that we were able to drive through cleanly during practice and the qualifiers, we can't during the main event. How many times have you been corner marshalling and seen the same vehicle crash on the same obstacle every lap? Don't be that guy. If you go through a corner and flip once, it may be a fluke. If it happens twice, you're probably catching a rut or simply going in too fast or nailing an exposed rock. It actually doesn't matter. Just change up your line. The same goes for jumps. If you case the landing on a big jump once and crash big, you might have just goofed. If it happens twice, you're probably aren't getting the run up you need to clear the jump or the face of the jump has changed. Change your line and don't try the big jump.

4. Walk the track: That nice elevated view from the drivers' stand might allow you to see the whole track, but it also prevents you from seeing the *whole* track. Get down and walk the track. The pros all do this for a reason. Look for all those ruts and divots that you'll never be able to see from the drivers' stand. In addition to finding obstacles you need to avoid, take a good look at how you want to progress from corner to corner. See how exiting one corner will set you up for the next turn or jump. Sometimes it will make sense to exit a corner wide so that you are properly positioned to cut the next corner tight or avoid a rough section. Do a walk during

practice and then again before the mains. Rhythm sections often get worn down in spots by the time mains roll around and a close walk will reveal a smoother, faster line than you had been taking.

5. Don't panic: No matter what, it's just a toy car race. If you get passed, forget about it. The harder you try to chase someone down, the more likely you are to lose focus and crash. If you get in an accident and get passed, the only thing you should think about is driving cleaner. If you focus on regaining spots, you will make more mistakes and continue to fall back. While you have to be aware of the other vehicles and be a courteous driver, it is actually best to run your race as if you're the only one out there. This mindset will keep you focused. If you get hacked, instantly let it go. Every second you're thinking about it is less time you concentrated on driving your best.

6. Set realistic goals: There's a lot more to racing than just where you finished. After each round of qualifying, look at your best lap time, average lap time and total laps and try to improve on those in the next round. Do that and the victories will follow. If you are already winning, this strategy will keep you on top. When reviewing your times, if your fastest lap is significantly faster than your average lap time, you're not consistent and the likely cause is crashes. Drivers who focus only on finishing position rarely see improvements.

10 Tips For the Perfect Build

Even in this RTR age we're in, there's still a whole lot of building going on in RC. There are still plenty of kits and lots of hop-ups and modifications that can be done to pre-built vehicles. Wrenching is easy. Anyone one can throw a kit together and go race. And, anyone can slap some aluminum goodies on a basher and go tear up the lawn. Like I said, it's easy and yet I am always amazed when I see a sloppy build. You know what I'm talking about. The vehicle that just looks hack. Don't be that guy. Instead, check out these tips for the perfect build.

1. Use Flush Cutters: This one is number one on the list for a reason. Get some high-quality flush cutters. I'm not talking about discount store side cutters that are anything but flush cutters. Instead, check out high-quality side cutters from Tamiya and Hobbico and say goodbye to those plastic little nubs left over on parts broken off from a parts tree. Not only do those little bits look hack (there's that word again), but if they're on a suspension or drivetrain part, they can impact performance by causing binding or parts rub.

2. Read the Directions First: I know it might be manly to say you don't need instructions, but I always read the instructions before starting a build and I reread each step before starting it. This is the key to eliminating building mistakes. Read the instructions and take notes in the manual as you go along.

3. Work in a Clean Area: Whether it's your workbench or the kitchen table, clean the space you'll be working in. You'll be far less likely to lose parts or get dirt where you don't want it if your work area is clean. I always build my shocks and differentials on clean paper towels also. Some small parts trays will be real handy at keeping screws and the such organized as you build.

4. Screw Parts Together Correctly: Here's a secret you probably haven't heard of: before tightening a screw, turn it counterclockwise slightly and then turn it clockwise to tighten it down. This little move seats the screw properly in the hole or nut and greatly decreases the odds of a screw getting cross threaded. Next, thing you need to know is that there is a fine line between tight and over-tightened. Snug down all hardware, but don't go all Hulk on the screws or you'll just strip them out. Every material is different. Take your time and just slowly tighten each screw down. When a screw bottoms out and feels tight, resist the temptation to give it one final crank.

5. Neatness Counts: When you're all done with the chassis and suspension and your ready to install the electronics don't switch to rush mode. Take your time and make sure the wiring is as neat as possible. Put some real thought into the path of the wiring. Use a few small cable ties to keep wires away from moving parts and use narrow strips of servo tape to keep servo wires down on the chassis. Also, make sure the wires are long enough to be slightly loose. Your chassis will flex, so you don't want the wires from your speed control to your motor constantly getting stretched.

6. Use A Lot of This And Little of That: Two things I recommend using a lot of are O-ring grease such as Associated's Green Slime and black grease used on thrust bearings. I'd say it's impossible to use too much of either one of those greases. On the other hand, I don't recommend using a liberal amount of silicone grease when building a ball differential. Use just enough to

lightly coat each diff ball. An excessive amount will just get flung onto the gears inside the transmission and this sticky grease will actually cause drag on gears that are usually made to run dry.

7. Turnbuckles Done Right: Almost all turnbuckles are made with some sort of indicator that shows thread direction. Make sure each turnbuckle and steering link has this mark or indicator on the same side. Having them all mismatched is a little, well, hack. Even more important, doing it right will make adjusting your suspension and steering easier.

8. Test the Drivetrain: As you build the drivetrain continually test that it spins freely. Check and recheck as you go along. Make sure each bearing is properly seated, that the gears are meshing correctly and just make sure it spins freely. There's no point in having a fast motor and the latest battery if all that power is going to get wasted in a binding drivetrain.

9. Test the Suspension: After you've built the suspension and before you bolt on the shocks, make sure each suspension arm moves freely. Lift it up and let it drop. It should move easily and without any binding or noticeable resistance, and it should smoothly and quickly drop under its own weight. If it doesn't, find out where the binding is occurring. You may have to loosen pivot ball caps, ream out the suspension arms or file some parts. Just take your time make sure each part of the suspension pivots smoothly.

10. Use the Right Screw: I see this all the time and it amazes me. What I see is kits built where the builder clearly used the wrong screw in multiple areas. It looks sloppy when a clearly too long of a screw is hanging out of a part, but it also means that some other part is improperly fastened with a screw that is too short. Get a ruler or set of calipers and check each screw as you build.

Tires

Hard Compound Tires
Hard compound tires are a good choice when you are running on a very soft surface. Examples of these surfaces are loose dirt, mud, a damp surface or fresh grass.
The principle design of these tires is that the tire does not move, but the surface does. Since this type tire has a very stiff side wall they are insensitive to foam insert changes.

Medium Compound Tires
A medium compound off road tire works very well on most dirt surfaces. If the track or surface you are running on is very dusty, or is starting to break up a medium compound tire is a very good choice.

Soft Compound Tires
A soft compound tire is designed to work very well on very hard surfaces. If the surface or track has what is called a blue groove condition a soft compound tire would be a good choice.
A blue groove condition is when there is a substantial rubber build up making the surface a darkish gray or black.

A good general rule to go by is the harder the surface the softer the tire and the softer the surface the harder the tire.

Selecting the right charger

You are about to make one of your most important RC purchases here so do your homework and get it right the first time! There are so many types and models of chargers available today it's easy to get overwhelmed when trying to figure out which one is best for you. There are 2 types of chargers that I will discuss here.

The first type we refer to is a "DC" charger. This type of charger requires the use of a separate 12 volt AC/DC power supply when charging from an AC source. You must plug in the power supply to a wall socket first then plug in the charger input leads to the output of the Power Supply.

The second type is an "AC/DC" charger. This type of charger has its own built in power supply. In general chargers that have built in power supplies usually tend to be the less expensive models.

Chargers that require an external power supply generally have greater power needs. You will need to decide if you can use a smaller compact charger that has its own built in power supply or if you need a larger more powerful unit that requires a separate power supply. My advice is if you use your charger outside and live in an area that is hot like us here in AZ, get a DC only charger and use an external DC power supply.

Here are the basics you will need to know to help you make a more informed choice.

How many watts do I need?
One of the most common misleading ratings I see is the charge rate listed by the charger manufacturers. All chargers have a maximum power rating which is referred to as "maximum watts". Most of the basic charger models are rated at 50 watts, so we'll use this for our example. What many people do not understand is one of the most basic laws of electricity. It is called "ohms law". What this law of physics says in simple terms for our needs is this. If you multiply the voltage of the battery being charged by the amp rate the charger is set at you can easily calculate the "watts" of power the charger is using.

For example: A 2s Lipo is charging at an amp rate of 5 amps. The voltage of the pack is 4.0 volts per cell or 8 volts total. At this point the charger is using 8(Volts)X5(Amps)= 40watts. Now let's say you are charging a 4S lipo at 5 amps at the same voltage (4 volts per cell) and the pack is now at 16 volts. 16X5=80 watts. If you try to charge a 4S pack at 5 amps when the voltage of the pack is at 16 volts on a 50 watt charger it wouldn't work. Since 50 watts is the chargers maximum power limit, the maximum amps the charger can charge at 16 volts is 3.125 amps.

This rule applies to ALL "DC" chargers. If you can live with charging a 4S pack at 3 amps, or are only charging 2S packs, then a 50 watt charger will work just fine for you. If you plan on charging 3S or 4S packs stepping up to an 80+ watt charger would be a wise decision. If you charge higher than 4S packs you should get an even higher wattage charger. Always find out the watt rating of a charger FIRST! This should be your #1 consideration when deciding on what charge to buy.

Now that you know how to figure out what wattage charger you need, you can move on to the next step.

Do I need a multi chemistry charger or a Lipo/Life only charger?
You will need to decide if you are going to charge only Lipo/Life packs or if you want a charger that can charge all types of battery chemistries such as ni-cad, ni-mh, PB (lead acid), lipo, life, and lithium Ion. Most of today's chargers do all types of batteries so this type of charger is the most common choice. One thing that I do want to point out here though is that there are some Lipo/Life only chargers that have one distinct advantage and that is "automatic cell count selection". What this means is once you plug the lipo battery's power and balance plugs into the charger it will automatically know the correct number of cells in the pack. If you plug a 3S pack into the charger it knows it's a 3S. This way you don't select the wrong number of cells, push the start button, then a little while later POOF, you've started a fire! I've seen it happen firsthand!

What features are most desirable?
If you plan on charging nimh cells make sure the charger has adjustable peak detection. It will save you a lot of hassles down the road. An automatic current limit function is a big plus for charging older ni-mh packs especially if they have sat for a while. For Lipo's make sure the charger has built in cell balancing. This is a must have feature! Most Lipo packs sold today come with an "XH" style plug and this type of balance port is the most common type found on today's chargers. Most of the chargers sold today also come with additional balance boards to fit just about any type of balance plug you can find. Make sure the charger has "discharge" and "storage" mode functions as well. The keypad can even be an important decision as well. If you are going to use the charger outdoors in dusty conditions buy a charger with "sealed membrane" buttons. Some of the "push button" chargers allow dust to enter the body of the switch can eventually lead to the failure of the button rendering the charger useless.

On a final note I want you to understand that just about everything electronic is manufactured in China these days. So wherever you buy your charger, make sure you get at least a 1 year replacement warranty! Also consider the cost of postage and other risks if you purchase directly from a Chinese supplier especially if you have to send a defective unit back!

Lipo Batteries

What is the best Lipo choice for me?
This depends on what you are using the battery for. If you race competitively you will certainly want a higher "50C+" rated battery. If you are a casual racer or just backyard bashing you will be fine with a 25C rated battery. We do not recommend using lower than a "25C" rated battery pack as voltage drops may cause radio glitches. If you are using 2 2S packs in a 1/8th scale buggy or Truggy we recommend using at least 40C rated packs or higher as these types of vehicles draw very high amounts of current.

What is the "C" rating?
The "C" rating is a number that battery manufacturers use to rate the maximum amp draw a pack will withstand. It has been reported to me that the parameters for establishing this rate are as follows. The manufacturer measures the highest amp rate at which a battery will yield 80% of the stated capacity of the pack. So let's say for a 5000 mah 50C pack, it would yield at least 4000 mah of capacity when discharged at 250 amps from a fully charged state to a cutoff of 3.0 volts. It says nothing of what damage was caused to the pack after this test, only that it accomplished the test once. Take from this what you want. The "C" rating of a pack is probably the most ambiguous measure performance that I have ever seen. Hopefully in the future a "real world" measure of performance can be established.

Some companies really inflate this rating so it is important to understand that the "C" rating is subjective. A higher C rating from the same manufacturer should give you better performance and longer cycle life. Also remember that buying a lower "C" rated battery and running it in a high current draw application such as 1/8th scale cars will overstress the battery and cause the pack to "swell".

What does the "S" stand for in a "2S" or "3S" Pack?
The "S" stands for the number of cells in the pack. A 2S pack is a 2 cell pack and is rated at 7.4 volts. A 3S pack is 11.1 volts, 4S 14.8 volts and so on. Basically each cell is 3.7 volts.
Why does my 2S pack charge to 8.4 volts? The "rated voltage is a median number used by the industry to rate the average voltage of a battery cell. When fully charged each cell in a Lipo pack will reach 4.2 volts. The lowest voltage you should discharge your lipo packs to is 3.0 volts per cell (6.0 volts for a 2S pack). I personally recommend a minimum voltage cutoff of 3.2 volts per cell.

What is the plug attached to the small wires coming out of the pack for?
This is the "balance plug" and is inserted into the output balance port of the battery charger. It allows the charger to adjust the current so that each cell in the pack reaches the same (4.2) voltage at the completion of the charge cycle. Make sure the balance ports match the balance plug on the battery pack as there are a few different types of balance plugs. The most common is an XH plug and is found on most brands of Lipo chargers. Adapter for different types of balance plugs are available and many chargers come with different balance adapters.

What do I do with the balance plug when I'm running the battery?
Nothing. The balance plug is only used for balancing during charging or discharging.

What do I do after using the packs?
After you are done using your Lipo battery make sure you unplug the battery from the car! Leaving a Lipo battery plugged into the speed control (even with the switch off) for extended periods of time can cause the voltage to drop too low causing permanent damage to the pack. Make a habit out of removing the pack from the vehicle and putting the pack into a lipo bag. Just put it in a cool dry place. If you don't plan on running the pack for a month or longer charge or discharge the pack as necessary to get the pack to 3.8 volts per cell. For example a 2S pack should be at 7.6 volts. This is referred to as a storage charge. A trick for extending the life of a Lipo packs is to place the pack in a plastic storage bag and put it in the Refrigerator. Allow them to return to room temperature before charging them. Never ever leave a Lipo in a hot car! Although Lipo's are designed for a maximum temperature of 140 degrees F, a temperature of just 104 degrees F for an extended period of time can cause "puffing" and will cause permanent damage to the pack. Cooler is always better.

Charging: You **MUST** utilize a charger **specifically** designed to charge Lithium Polymer batteries with a balancing circuit.

1. Set the cell count selector:
If your charger has one, you must correctly set the cell count for the battery being charged. If your charger has an automatic cell count selector move on to step 2. For example a 2S Pack has 2 cells or 7.4 Volts. A 3S has 3 cells or 11.1 Volts etc. Make certain that the balance ports on your charger are the same type as the balance plug on your Lipo Pack. If not an adaptor will be required. Plug the balance tap into the proper port on your charger.

2. Set the charge rate:
Although some Lithium Polymer Batteries are rated at a 2C or higher charge rate we recommend you charge at a rate of 1C (1 x (C)apacity). For example, to charge a 5000mAh pack the charge rate would be 5 Amps. 1000mah = 1 amp.
Always monitor the progress of packs while charging. Never exceed the recommended voltage of 4.2 volts per cell (8.4 volts for a 2S pack).

3. Make sure the balance feature is turned on. Even though some manufacturers may say balancing is not required every time, we highly recommend you balance charge **every** time for maximum pack life.

Use of a Lipo sack while charging is also highly recommended and is required by many race tracks and by ROAR for their sanctioned events.
Discharging: Lipo batteries DO NOT FORM A MEMORY so discharging them is **not** necessary and wastes cycle life!

Never ever allow a Lithium Polymer batteries voltage to drop below 3 volts per cell. The low voltage threshold for discharge (under a load) is 3.4 volts per cell. Allowing any cell in the pack to drop below this voltage will irreversibly damage its internal chemistry and ruin the pack.
Storage: **NEVER LEAVE A LIPO PACK FULLY CHARGED FOR MORE THAN A FEW HOURS!** When you do not plan on using your Lipo pack(s) for more than a few weeks it is

necessary to put a "storage charge" into them. A storage charge is about 50% of the rated capacity of the pack. Some chargers may even have a "storage charge mode". This is about 3.8 volts per cell or 7.6 volts for a 2S pack. If your pack is above this voltage then you will need to discharge the pack to this voltage level and if the voltage is lower you will need to charge the pack up to this voltage level. Putting the packs in a refrigerator will help to extend pack life! Put the pack(s) in a sealed plastic storage bag and put them in a safe spot away from food. **DO NOT LEAVE YOUR PACKS OUT OR LEAVE THEM INSIDE A PARKED CAR ON A HOT DAY!** They will "puff up" and cause permanent damage to them. HEAT is the #1 enemy of Lipo packs!

General Rules: - If for any reason, a Lithium Polymer battery appears deformed or is unusually warm to the touch, or after any unusual circumstances (such as a crash), take extreme caution. Lithium Polymer battery packs with internal chemical leaks have been known to burst minutes, even hours, after being damaged.

Always disconnect your battery after every use. Even though the switch on your speed controller is off, there is still a small amount of current being drained from the battery!
If your speed controller has adjustable cuttoff voltage set it to 3.4 volts per cell. This will vastly reduce the chance of overdischarging one or more of the cells in the pack. **Do not use Lipo packs in vehicles without Lipo cutoff circuitry!**

DO NOT PULL ON ANY OF THE WIRES EXITING THE PACK! THE WIRES ARE NOT "HANDLES" TO LIFT THE BATTERY OUT OF THE CAR. I CAN'T TELL YOU HOW MANY TIMES I HAVE SEEN LOCAL RACERS AT OUR TRACK LITERALLY YANK THE WIRES RIGHT OUT OF THE PACK WHILE BEING IN A HURRY TO CHANGE OUT THEIR PACKS!

The harder you work the battery the shorter the cycle life will be. Do not expect to drain a 5000 mah pack in 5 minutes and get very many cycles out of the pack! For this reason you should always buy the highest "C" rated battery you can afford if cycle life is important to you. Make sure you do not exceed the "C" rating at any time during the discharge of the pack. **One way to tell if you are overworking the battery is to check the temperature of the battery pack with an IR temp meter before and then again immediately after a race/run. If the battery is more than 10 degrees hotter than when you started you are most likely overstressing the pack!**

Why You Should Balance Your Packs: Standard lithium battery chargers and battery cut-off circuitry, such as that found on electronic speed controls, must rely upon the average voltage of the entire pack to determine when charging and/or discharging is complete. This is because the cells in the pack are effectively wired in a series configuration . Unfortunately, this has a negative drawback. If for some reason one of the cell's voltages becomes higher or lower than the other cells in the pack, the charger or battery cut-off circuit may improperly sense the voltage of the cells in the pack (because of voltage averaging). When this happens, the averaged voltage of the pack will no longer properly reflect the voltage of each cell in the pack. This improper information may lead to the over-charging or over-discharging of one or more of the cells in the pack. Lithium Polymer chemistry is such that over-charging or over-discharging will

substantially reduce the life of the pack and in extreme cases, POSE A SERIOUS FIRE HAZARD.

Taps - Lithium Polymer batteries are equipped with special plugs called "Taps." Tap plugs provide access to each cell in the pack individually. Individual access to each cell provides reliable voltage readings, allowing one to correct an imbalance should one develop. Taps allow each cell to be charged individually. However, Taps must be shown a great deal of respect. Depending upon the equipment used, it may be very easy for one to accidentally short one or more of the cells by simply allowing testing gear or exposed testing leads to come into contact with one another or a conducting surface. The balance tap wires are small and somewhat fragile so take great care when handling them.

TAKE EXTREME CAUTION WHEN USING TAPS. Take every precaution to prevent short-circuiting Lithium Polymer cells, not just because this will almost instantly ruin the cell, but because it may pose a fire hazard. PAY CAREFUL ATTENTION TO THE BALANCE WIRES COMING OUT OF THE PACK. DO NOT ALLOW THEM TO GET CRUSHED OR EXPOSE THE BARE WIRES. DO NOT ATTEMPT TO CUT TAP CONNECTORS OFF OF A LITHIUM BATTERY PACK - THE CUTTING INSTRUMENT IS CONDUCTIVE AND MAY SHORT-CIRCUIT THE CELLS!

A number of products are on the market to facilitate cell balancing for packs with Tap plugs. A properly configured adapter and use of a pack balancer will greatly reduce the risk of mistakenly short-circuiting a cell. Taps, when used properly, are a great feature, and should significantly improve the life and performance of your Lithium Polymer batteries.

Do Not short circuit Lipo batteries! Do Not open battery or dispose of in a fire!

Fire: In the rare case of a fire where lithium batteries are present, apply a smothering agent such as METL-X, sand, dry-ground dolomite, soda ash, or flood the area with water.

A smothering agent will help extinguish burning lithium batteries. Water may not extinguish burning batteries but will help to cool any adjacent batteries and control the spread of fire. When water is used, however, hydrogen gas may evolve. In a confined space, hydrogen gas can form an explosive mixture. In such a circumstances, smothering agents are recommended.
Disposal: To properly dispose of a Lithium Polymer Pack cover the pack with sand or dirt and discharge the pack to less than 1 volt per cell then drop the pack into a bucket of salt water (1/2 cup salt to 1 gallon of water) for 2 weeks. Wrap in newspaper and toss into the trash. The packs are landfill safe at this point.

Choosing the Right LiPo—What is Best for You?

It is hard to believe, but just a few short years ago, Lithium-ion polymer (LiPo) batteries were new to the industry. Since then, not only have LiPo's come to the forefront, but they are partially responsible for resurrecting electric RC altogether. Li-Po's, compared to the NiMH technology they replaced, are lighter, deliver more linear current, have higher capacity, last through many more cycles, and are a lot more user-friendly. If you are choosing your first LiPo pack—or are thinking about investing in another—here are some important variables that you will find among packs on the market.

Voltage
When selecting a Li-Po pack, the most important variable is voltage, which determined by the number of cells in series. The most common LiPo application is a 7.4V (2S) pack, which most closely mimics the voltage used in an old-school 6-cell NiMH pack. If you are trying to achieve insane speeds, however, or run a large-scale electric vehicle, an 11.1V (3S) or greater may be a better fit. Most of the time, you are limited by the ESC capabilities and room on the chassis. Do some research and chose to correct voltage for your vehicle.

Capacity
Simply put, capacity—expressed in mAH—deterimes the potential runtime of a LiPo. Capacity may be determined by increasing the number of cells in parallel. Assuming the cells are identical, a 3P battery should have a higher capacity than a 2P battery. Higher capacity batteries are generally larger and heavier than lower capacity, so a 8000mAh pack may not necessarily fit in your vehicle. In general, chose the highest capacity battery that will fit comfortably on the chassis.

Balancing
Since a LiPo pack is made of multiple, smaller LiPo cells, they all must work together in harmony. Although their synchronization is pretty consistent, the cells do not necessarily charge and discharge equally. Some packs have balancing ports which allow for the use of a balancer while charging. The balancer addresses each cell individually and 'balances' the charge in each cell. There are various balancers and ports on the market, so make sure to purchase the correct type for the battery, although not all batteries are balancer-compatible.

Battery Case
LiPo cells themselves are flexible and delicate. They are not rigid like sub-c type batteries and require supplementary protection. Some packs offer more protection than others. Most packs on the market use a rigid plastic case to protect the internal cells—where some use a thinner more flexible case. If given the choice, use the most rigid protection possible. Also, some cases are designed for use in certain vehicles. Most cases are rectangular and have corners, but some cases—designed for cars that use stick-type sub-c packs—have more rounded edges that fit better in the chassis.

Wires
Many LiPo packs use wires connected to Zero Loss plugs, which then plug into the battery. These are generally a better option than a pack which doesn't use Zero Loss plugs, because

unlike sub-c cells, LiPo's are NOT rebuildable. So if a wire frays, it needs to be replaced, and if you don't have replaceable wires the pack is essentially ruined.

Connectors

It wasn't long ago that there were only two options for battery connectors: Tamiya-style and Deans Plugs. Tamiya-style connectors are notoriously terrible, and could never handle high-current applications—leaving Deans plugs to pick up the slack. Although Deans Plugs are still among the best on the market, Losi and Traxxas also produce high-end connectors that can handle high-draw LiPo applications. When selecting your LiPo pack, chose whichever plugs that will work best—as long as they aren't Tamiya plugs.

C-Rating

A pack's "C-rating" refers to continuous discharge potential. The higher the C-rating, the more Amps are available for discharge, and in turn, acceleration improves. But as tempting as it is, do not assume off the bat that a 30C battery will perform better than a 25C. Unless you are running a high RPM (kV) motor, you will never need anything more than 25C to begin with. And even if you are running a hot setup, as most racers know, more speed does not necessarily mean lower lap times. Only focus on C-rating if you are looking for additional ways to make your already fast car a little faster at high RPM.

Although LiPo technology is relatively new to our industry, it spawned from the need for better cell phone and laptop batteries. The RC car industry has always done a great job in adapting new technologies for the RC realm. Now, there are a number of different Li-Po batteries on the market, but they all share the same lingo. If you are looking to purchase a new LiPo pack, do some basic research, and chose the best pack for job.

Keep it Cool!–Heat Kills Electronics.

Motors, speed controls and batteries are some of the most expensive components on our electric cars. I'm sure you have blown up one of these at some point and know the agonizing feeling of breaking out your wallet to replace it (or waiting weeks for warranty repair).

Motor or speed control failure is often caused by heat. ***Heat and electronics do not mix.*** Electronics are more efficient and reliable at lower temperatures. It is always a good idea to run your motor and esc as cool as possible. If you keep them cool, they should last longer and most likely increase your runtime. Here are a few tips to keep them cool:

- Cut vents in your body to allow more **air flow**. Remember, hot air rises so holes above your motor or esc are usually a good idea.
- A good rule of thumb for **brushless motors** would be **170 degrees**. Some motors can handle well above that but remember excessive heat will wear motors out much faster. Magnets dislike heat just as much as electronics. If you are having trouble staying around 170 degrees, check your gearing, lower the mechanical timing on your motor, or turn the boost down on your ESC.
- If you run your motor to its limits and it's getting too hot, **limit your runtime** and let your motor cool.
- **Use a heatsink or fan**. Most ESC's have both standard but not many motors do. Adding a fan to your motor can often cool it by 20-30 degrees.

Here are a few motor manufacturers' recommended **MAX** motor temps:

Novak – 175 degrees F
Tekin – 180 degrees F
LRP - 195 degrees F
Castle – 180 degrees F

Budget RC—Ways to Save Money

RC is expensive, and that is a fact. If you are into RC, chances are that you even have more disposable income than the average person. But just because you have a little extra money to burn, it doesn't mean that you wouldn't benefit from being able to save a few bucks as well. Stretching your budget will allow you save money in the long run, so that you can spend it elsewhere, and perhaps stay out of trouble with Citibank or the Missus. Here are some money-saving tips:

Buy One-run Tires
Professional racers only use a new set of tires for one-run on the track. It may seem wasteful, but keep in mind that they get everything for free! For most club racers and bashers, these one-run tires are more than sufficient. If you go eBay, it is easy to find gently used wheels and tires and a bargain price.

Don't Splurge on Tools
Although it is good to buy RC-specific tools, it isn't exactly necessary. Instead of spending $12 each on a Hudy hex wrench, you can get away with spending a fraction of the cost on a nice Craftsman wrench at Sears. If you have the money to burn, expensive tools are always nice, but for most people a stop at Home Depot or Sears is a better alternative.

Carpool to the Track
It is almost a rule that RC tracks are only located in the middle of nowhere, and when you add in $4.00/gallon gas prices, you may spend $30.00 just driving back and forth from the track itself. Everyone values their independence, but carpooling with a buddy to the track can help you save a bunch in the long run.

Help-out at the Track
RC tracks generally don't have a lot of money to pay employees, so many of them rely on volunteers to help maintain the track itself and facilities. If you become a regular volunteer, chances are that the track owner/director will take notice and eventually let you practice or even race for free!

Read Pit Tips
The Pit Tips column of Car Action has always been a reader-favorite, because it usually offers quick, cheap, homebrew fixes and suggestions for RC maintenance. Some are more useful that others, but most of them are do-it-yourself "MacGyver" tips that can help to save money.

Go Brushless
Sometimes spending more initially can help you to save in the money in the end. If you run electric RC, investing in a brushless motor system will save you hundreds of dollars in brushes, springs and motor maintenance over time. You will also get better runtime and have a more efficient drivetrain—another money-saver.

Care for Your Bearings

Bearings are expensive to replace—especially ones that are really large or exceptionally small. If you properly care for your bearings, however, they will last a lot longer. Clean and re-oil your bearings frequently, and learn how to take your bearings apart to clean them internally. A little bearing maintenance will go a long way in extending their life.

Body Wraps
Although professional paint jobs are amazing, they can cost upwards of $100, even if you do them yourself. To get a nicely finished look at a fraction of the cost, purchase vinyl body wraps instead of going crazy on paint. For under $20.00 you can usually find great-looking wraps for almost every RC body on the market.

Have a Beater Body
If you do have an expensively-painted body, save it for race time or photo-ops like Readers' Rides. For practice or bashing sessions, keep around a beater or practice body. There is nothing worse than messing-up and expensive body when you are just messing around, so reserve your shelf-queen body for special occasions only.

Use a Bumper
Although it violates RC Cool 101, using a bumper is a great way to avoid damage to your vehicle and save tons of money in broken parts. Thankfully some cars and trucks look better with bumpers than others. You may even be able to find a small, discrete bumper that will be hard for anyone to notice on your car.

Use After-run Oil in Engines
Nitro RC engines can have a very limited life if they aren't cared-for properly. A good way to ensure that your engine will last longer than one season is to store it properly between runs—especially in the off-season. Using after-run oil in the carburetor and piston sleeve will lubricate the internals and prevent parts from binding and grinding when the engine is restarted. This will greatly increase the life of your engine.

Buy Last Year's Car
The Internet is a beautiful for RC. Although it is fun to buy the newest and latest chassis every year, you can save hundreds of dollars by buying used vehicles and equipment online or from someone at the track. Unless you are an A-Main driver, you don't need to spend $700.00 every season on the latest truck or buggy. You will save money, and probably even be faster, by buying an older car and spending a little more money on practice.

Stay Organized
Between your car itself and all of the tools in your pit bag, there are literally thousands of parts to keep track-of on a day-to-day basis. Everyone has lost numerous tools and parts at the track and around the house, which seem to disappear forever. But if you keep your car and tools organized, and do consistent inventory throughout the day, you are much less likely to lose things for good—saving tons of money.

Subscribe to Magazines
Back in the day, RC magazines were only $2.99 at the newsstand. But with things like inflation,

rising printing costs, and economic downturn, most of the industry magazines are now around $6.00! You can save yourself almost $50.00/year by subscribing to magazines rather than purchasing them individually. In fact, you could subscribe to two different magazines for less cost than buying one at the cover price every month.

Rechargeable Transmitter Batteries
RC transmitters have always used a ton of AA batteries—which really add up in cost over the course of a season—especially if you are the kind of person who accidentally leaves the transmitter on between runs. Investing in rechargeable batteries is a great example of how spending a little more initially can save a lot of money in the grand scheme of things.

Run a Little Rich
Most people, especially novices, make the mistake of tuning their engines to maximum power. While running lean is great for speed, it is can wreak havoc on engine life. Running a little richer, however, can extend engine life indefinitely. When tuning your engine, find the point where you achieve maximum power, and then richen the high-end needle by an hour. This will give you a good balance of speed and longevity.

Keep your Car Clean
Accumulated dirt and road grime can cause parts to wear excessively and break prematurely. Keeping your car clean between runs, however, is great way to avoid spending unwanted money on replacing broken parts. After every run, clean and inspect every area of the chassis. You will discover things like small rocks caught in outdrives, which would eventually get caught in the wrong place an jack-up the drivetrain—leaving a huge price tag as a result.

Conclusion
Even though RC is one of the most expensive hobbies known to man, there are still tons of ways to save money. Over time you will figure out which purchases are useful investments, and which ones are simply a waste of money over time. So to keep your debit card and loved ones happy with you and your RC obsession, find ways to cutout unnecessary costs.

13-Upgrades for Under $50

Although you can easily spend hundreds of dollars on a single RC upgrade, there are numerous upgrades that you can make without breaking the bank. Sure, brushless motor systems, fully-digital transmitters, 11.1V LiPos and race-tuned nitro engines are among the most expensive and sought-after products, but there are actually tons of upgrades that can be found for relatively little cost. In fact, many of the most useful upgrades on the market are under $50, and here are 13 inexpensive upgrades that are sure to make a big difference:

New Wheels and Tires
Your car's handling and performance on the street and track are only as good as its tires. If you are looking to increase handling and decrease lap times, try experimenting with some new wheels and tires.

A New Body
The biggest aesthetic upgrade you can make to your vehicle is painting and mounting a new body. For under $50 you can buy a brand new body and create a unique paint scheme of your own.

Titanium Turnbuckles
Over time, you are destined to bend, tweak or outright destroy turnbuckles on the streets or at the track. Since they are stronger and lighter than steel, upgrading to Titanium turnbuckles will increase durability and performance in one shot.

Upgraded Connectors
Most ready-to-run vehicles still use Tamiya-style connectors that are grossly inadequate for today's motors and batteries. Upgrading to performance connectors like Dean's, Traxxas or Losi will give you better runtime and more punch.

ESC Fan
Keeping your ESC cool can boost its performance and increase its life. Many newer ESCs offer optional cooling fans that bolt directly to the ESC case—taking ESC performance to the next level.

An Extra Battery
Although battery packs can get expensive, plenty are still available for under $50. Buying an extra pack will give you more time to have fun—especially if you aren't close to an outlet—and will extend the life of your other packs, since you aren't constantly charging and running the same ones.

Machined Aluminum Motor Mount
Nitro engines generate a lot of heat, and pulling that heat away from the engine block is important. Aftermarket companies make machined motor mounts for nitro engines which save weight, promote cooling and even stiffen the chassis for tuning purposes.

Shock Rebuild Kit
All shocks require maintenance, and buying a rebuild kit helps breathe new life into an old suspension. Rebuild kits usually include new o-rings, pistons, bladders and shock boots—all of which degrade over time and need to be replaced.

Motor Heat Sink
Electric motors—especially brushless ones—need to keep cool to run efficiently and extend durability. Buying a motor heat sink is a perfect way to draw heat away from the motor and get the most out of your ESC/motor setup.

Pinion/Spur Gears
Many people—especially novices—overlook the importance of gearing. Before you go motor shopping, try experimenting with different gearing. Just a couple teeth difference can add tons or torque or speed.

LED Light Kit
For you drifters, rock crawlers and scale-builders, nothing adds realism and flash like an LED light kit. They are available for just about every car and can usually be found for around $25.

Metal Gear Steering Servo
If you have a stock steering servo, it is just a matter of time before it conks out or strips a gear. For about $50, however, you can find a nice steering servo that uses ball-bearings and metal gears—increasing performance and life.

CV/Universal Drive Shafts
If your vehicle uses dog bone-style drive shafts, upgrading to CV or universal-style shafts will greatly improve drivetrain efficiency—which has numerous positive effects on your car's performance.

Conclusion
RC upgrades don't always have to cost over $200. In fact, some of the most useful upgrades on the market are under $50! So much about RC performance is about the "little things," and thankfully little things usually involve little cost. So before you dump $200 into your car, think about getting four smaller upgrades instead; you will probably be better-off in the big picture.

9 Easy Soldering Tips

Soldering is one of those tasks that you either really enjoy or greatly despise; RC maintenance is often like that. Even if you are a nitro guy, soldering comes-up more than you'd think, and if you run electric, soldering is a vital necessity. Most beginners—and some veterans—are intimidated by soldering jobs, but if you keep a few important tips in mind, soldering can be easy and will become something you look forward to, instead of cringe over.

Use a hot iron
Soldering is a lot easier when you start with a hot iron. Avoid using an iron that is less than 40W. Low wattage irons can put your equipment at risk, because holding the iron in place too long, waiting for the solder to melt, can easily damage your components by overheating.

Pick the right tip
There are a number of different soldering iron tips on the market, and they can be used for specific tasks. In general, however, stick with a broad-faced, chisel tip. The extra surface area on the tip will improve the contact surface, allowing for more efficient heat transfer. Unless you are forced to solder in a confined space, avoid fine-tipped irons.

Wipe the tip often
Before you start a new job, dampen a sponge and keep it handy. You should wipe the iron tip with the sponge before you tin a new surface, and wipe it off in between steps. Iron tips accumulate flux, oxidation and old solder quickly, and wiping them off allows for more efficient heat transfer.

Use an iron stand
Even if you don't have a complete soldering station, you should at least purchase a coiled-wire iron stand. This gives you a place to keep a hot iron handy and will prevent you from burning your work bench and even yourself. Lying a hot iron on its side is dangerous and makes it difficult to use.

Score surfaces
Especially if you are soldering on flat surfaces, it is always useful to rough-up (score) the surface with fine-grip sandpaper. Scoring the surface cleans it and increases surface area—both of which aid in making a strong bond and prevent the solder bead from running.

Pre-tin surfaces
Any time you solder one surface to another, "pre-tin" both surfaces with a small amount of solder. When you move-on to binding the surfaces, the tinned areas will melt together much more easily than if one or both of the surfaces are naked.

Use a soldering jig
Although they may look ridiculous, investing in a soldering jig that uses alligator clips and a magnifying lens is a big help, especially when soldering connectors or wires to each other. The

jig works as your third and fourth hands—an invaluable resource considering that your first and second hands are full of the iron and solder itself.

Flux helps the flow
Most hobby-grade solder is infused with flux—as substance that improves the flow of melting solder. But for heavy-duty jobs with wide-gauged wires, brushing a little extra flux paste onto the surface before starting can help the melted solder flow and its heat remain homogenous.

Do the tug-test when done
When you are done with a job and the surfaces are sufficiently cooled, give the wire a quick, moderate tug. Solder isn't bullet-proof, but a good connection should sustain a few pounds of pressure. If your connection beaks with a slight tug, the bond is bad, and it was just a matter of time before it came loose on its own.

Neaten those wires

It's a fact: RC vehicles are laden with on-board wires. And to top it off, wires are delicate and often left of out in the open, where they are susceptible to damage and sometimes look plain old sloppy. From the very beginning, RC owners have searched for ways to combat loose wires. Over time, four simple and effective methods have been found to protect and clean-up the wiring mess on a car's chassis.

The Zip-tie Method

A great way to harness loose servo and power wires is by using small zip-ties. For servo wires, first bundle them-up neatly like an accordion, so that the flat sides of the wires face each other, and then strap a zip tie over the center, holding the bundle together. For speed control or motor power wires, bunch them together, and then strap zip-ties wherever needed, keeping them together instead of floating loose on the chassis.

Zip-ties are very strong and have hard corners. When using zip-ties to secure loose wires, be careful not to pull them too tight. An overly-tightened zip-tie can easily sever a wire—especially over time. Always pull the zip-tie tight, but not so tight that it pinches the wires to the point of fraying.

The Coil Method

To make servo or receiver wires into neat, retractable coils, first wrap the wires neatly around the shaft of a screwdriver, starting at the base of the servo, working your way up the driver. With the entire wire wrapped tightly on the shaft, use a heat gun (on medium heat setting), and apply heat evenly up and down the coil for 15-seconds. While still holding the coil in place, remove the heat gun and let the wire cool-off for a minute. After it has cooled-down, slide the coil off of the shaft, revealing something springy and beautiful!

Although the coil method is effective, it isn't permanent. Coiled wires will need to be recoiled over time, so only use the coil method where wires are easily accessible; otherwise it will be a waste of time. Also, never hold the heat gun in place for too long, as you could potentially burn the wires or insulation.

The Heat Shrink Method

Heat shrink can be used to corral loose servo and power wires. Start by organizing the wires that need to be routed. Next, feed them through the heat shrink one by one, until they are in the desired position. If someone is nearby, have them hold one end of the wire bunch, and then hold the other end yourself, so that the wires are taut. Finally, finish-off by applying the heat gun and letting the heat shrink do its work. After it has cooled down, the wires should be held tightly in place.

It seems obvious, but I have made the mistake of soldering wires before I placed the heat shrink more times than I would like to admit. Also, when soldering wires, make sure to keep the heat shrink far away from the iron, or else you will shrink the heat shrink tube prematurely.

The Fuel Tubing Method

To add extra protection and insulation to speed control and battery power wires, they can be slid into silicon fuel tubing prior to soldering them to the motor, battery or connectors. Using a brand new piece of tubing, simply push the wires through the tubing. It helps to use a little bit of WD-40 on the wire before sliding it through, because the rubber-on-rubber contact gets pretty "grabby" without lubrication. If threading unusually thin or wide wires, try finding a larger or small gauge of tubing to begin with, to make installation easier.

Although it adds extra thermal and abrasive protection, enclosing wires in fuel tubing does not make them bullet-proof. If your newly protected wires are close to moving parts or heat, make sure to inspect them frequently to ensure that they aren't being exposed to harmful elements. If you see wear on the fuel tubing, re-route the wires to prevent long-term damage to the wires.

Conclusion

Loose wires on an open chassis are a recipe for disaster, not to mention an unorganized mess. There are four good ways to ensure that loose wiring stays protected, keeps out of harm's way, and looks neat and organized. Best of all, these methods are inexpensive and easy to master—unlike many other parts of RC—which makes them a total no-brainer.

What to Bring to the Track

This is a check list of items to bring to the track. Although having everything would be cool, not all is necessarily needed.

Important RC Items

- Cars – ready to race
- Batteries – race packs, receiver packs, transmitter batteries
- Battery charger – with all proper connectors (don't forget Lipo leads)
- Power supply
- Transmitter
- Body clips – for body and transponder
- Car stand
- Pit towels
- Instruction manuals – for car, transmitter, ESC, equipment, and so on
- Power strip
- Table, chair, tent, Radio

Nitro-related

- Fuel
- Fuel bottle, fuel gun
- Glowplugs
- Glowdriver – with spare battery
- Glowplug wrench
- Starter box
- Extra fuel tubing

Tuning Parts

- CAR PARTS – diffs, swaybars, pulleys, shocks, tires, etc.
- Gears – pinions, spurs, clutch
- Clutches & parts, and so on
- Shock springs
- Tuning Guide

Spare Parts

- CAR PARTS
- Servos
- Receivers
- Bodies (and spare wings)
- Bearings
- Diff balls
- Hinge pins
- Pivot balls
- E-Clips

Setup Tools

- Setup system
- Camber gauge
- Droop gauges
- Ride height gauge
- Tweak bar
- Toe gauge
- Setup wheels
- Flat setup board
- Setup sheets & notes

Hand Tools

- Screwdrivers
- Allen wrenches
- Nut drivers
- Pliers
- Lexan scissors
- Files
- Calipers – digital preferred
- Side cutters
- X-Acto knives
- Body reamer
- Metal ruler
- Small paintbrush
- Old tooth brush
- Scothbrite pads
- Sandpaper

Fluids

- CA glue – medium and fast
- CA debonder
- Threadlock – medium (242 blue)
- Traction compound
- Motor spray
- Shoo Goo
- Comm drops
- Bushing/bearing oil
- Diff tube/grease

- Diff fluid
- Degreaser/cleaner (esp for your hands)
- Shock oil
- Neoprene cement – for repairing
- Contact cement
- JB Weld
- 5-minute epoxy
- After run oil

Support Equipment (Electric & Nitro)

- Soldering iron/station – with extra tips
- Solder
- Solder sucker,desolder braid
- Flux
- Spare connectors – battery bars, connectors, wire
- Motor rebuild parts – brushes, springs, shims, and so on
- Motor stand
- Electrical tape
- Discharge tray
- Discharge bulbs – with cutoff device if possible
- Brush hool alignment tool
- Digital multimeter
- Temperature gauge

Supporting Equipment (Miscellaneous)

- Pit towels
- Zip ties
- Extension cords
- Power strip
- Servo tape
- Calculator
- Note book
- Pen, pencil, marker (sharpie commercial works great for marking tires)
- Shop towels (paper)
- Shop rags (cloth)
- Zip lock bags
- Elastic bands
- Compressed air, air tank with hose

Personal Items

- Drinks …don't forget water!
- Food – things that can stay out without going bad
- Facecloth – for long days outside in hot weather
- Towels – clean towels you won't use on your cars, only on yourself
- Sunscreen – before a long outdoor main / DON'T put it on your forehead!
- Glasses / sunglasses
- Hand cleaner
- Earplugs – mostly for gas races … personal preference
- Cooler – for drinks, food, nitro fuel (in a separate cooler, please!)
- Hats (or headband to stop sweat dripping in your eyes)
- Gloves – for marshaling
- Pit apron
- Pitman – never leave home without a good pitman
- SENSE OF HUMOUR and HUMILITY – PRICELESS