



*Presents...*

# **REAL RACE**

**PROFESSIONAL RIC CAR SIMULATOR**

## *USER'S MANUAL*

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# Introduction

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## Introduction

Welcome to the RealRace™ Professional R/C Car Simulator, the most advanced car simulation available. So realistic you'll hardly believe it's a simulation. Whether you're a seasoned modeling veteran, or an entry-level R/C-er, RealRace™ is the ideal way to learn to drive, practice skills to be transferred to your next race, experiment with the effects of design modifications or just to have an incredible amount of fun.

Providing rapid answers to any questions in which you might encounter, this on-disk manual has been designed to further enhance your enjoyment of the program.

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## Minimum System Requirements:

### RealRace Program-

- Windows® 95/98
- Graphics and sound cards compatible with Microsoft DirectX 6.1 or later (most are compatible)
- 60 MB available hard drive space
- 4X CD-ROM drive
- Super VGA Monitor
- IBM-Compatible Game Port
- Pentium 266 or equivalent

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## Suggested for Optimum RealRace Performance:

- Pentium 300 or above

- High-performance 3D accelerated video card with at least 8MB video RAM
- 24MB RAM
- 16X CD ROM drive

*NOTE: Windows NT is not currently supported because it does not support Direct X 6.0. Windows 95 emulation boards for Mac and Unix systems are not supported.*

## Multi-player

- Pentium 350MHZ for two players
- Pentium 400MHZ for 2-4 players
- LAN: IPX/SPX or TCP/IP protocol
- Internet: TCP/IP connection requires an Internet Account and 28.8 modem. Connect time charges may apply.
- Head to Head Modem (2 Players): 28.8 modem required
- Serial Port (2 players): Null modem cable, high speed serial port
- One CD per computer

## Resolutions available:

- Dependent upon video card selected
- Ranges from 640x480 with 16 bit color to 1600 x 1200 with 32 bit color

*For complete system requirements, see [www.realrace.com](http://www.realrace.com)*

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## Installation Procedure:

### Program Installation

Prior to installation, ensure that all other applications are closed. Insert the CD-ROM into your computer. If auto-play is active in your computer, a dialog box will appear in a few seconds that will ask if you want to install the software. Click “Yes” to proceed with the installation. If auto-play is not active, it will be necessary to locate and run SETUP.EXE from the root directory of the CD-ROM. Choose the “Start” option from the main menu, and then select “Run”. In the “Run” window, type “d:\setup.exe” and press [Enter] or click “OK” (assuming d is your CD-ROM drive name).

After the program starts, fill in all the appropriate information. When the program asks for your RealRace serial number, use the serial number that appears on the CD-ROM case. After entering the RealRace serial number the “Next” button will become active. Click on this to continue with the installation procedure.

Once the program has finished copying the files, it will ask you if you want to install DirectX. If you do not meet the minimum DirectX version requirement as queried by the RealRace program, click “Yes” to install this version of DirectX. It will not harm your computer to install DirectX more than once. Therefore, if you are unsure as to the status of this program we suggest that you install it at this time. After DirectX has been installed for the first time, you will need to reboot your computer in order to complete the RealRace™ installation.

## **Controller Configuration**

When you first Run RealRace, you will be asked to calibrate your controller. Please follow the on-screen instructions that are presented to you. These will serve to lead you through the calibration process.

---

## **Features:**

### ***Summary of Features***

- Uses **VirtualRevolution™** sound technology
- Uses **RealPhysics™** technology
- 5 lifelike racetracks- complete with bonus 3D Terrain Module and 11 PhotoField™ backgrounds
- 11 realistic R/C on- and off-road, nitro- and electric-powered vehicles ranging from buggies to touring cars and even a monster truck.

### ***Windows 95 and 98 Compatible***

- Native 32-bit program
- Easy to learn user interface

### ***Uses DirectX***

- Thanks to the use of today’s DirectX technology, RealRace™ offers unmatched realism and performance
- RealRace™ may be utilized with DirectX compatible sound cards
- Thoroughly uses the entire RAM on your video card

### ***Graphics***

- Lifelike tracks inspired from real R/C racetracks
- Realistic track objects and barriers
- Multi-resolution ground textures to match your computer’s capabilities
- Photo realistic backgrounds complete the racetracks

- Supports Gouraud shading, bilinear textures, and dithering
- Extremely detailed R/C Cars

### **Sound**

- Employs Doppler-correct VirtualRevolution™ sound technology-heightening the realistic effect with true recordings of a variety of power-plants including 2-stroke and 4-stroke engines, and electric motors throughout their RPM range
- CD-quality soundtrack features a variety of musical styles and original compositions; including ambient sounds typically heard at driving sites
- Stereo effects. As the car crosses the track, the engine sounds follow, just like its R/C counterpart

### **Physics (General)**

- The exclusive RealPhysics™ technology calculates hundreds of thousands of floating point operations each second, delivering sizzling real time driving performance and accuracy
- RealRace™ employs a highly accurate, incredibly realistic detailed model of car dynamics that includes full 3D motion, rolls, and tumbling, as well as momentum, weight transfer, etc.
- You set up your car in RealRace just the way you would a real R/C car. When you adjust wheel alignment (toe in/out, camber, caster), shock preload, etc., RealRace simulates the resulting effect on car performance and behavior.
- Moreover, RealRace offers over 120 options and adjustable physics parameters to accurately, and authentically model a wide variety of cars
- Almost every single feature of the RealRace physics model (tires, shocks, engines, drive train components) was constructed from painstaking measurement and testing of real R/C cars and car parts

### **Physics (Tires)**

- Includes actual, detailed measurements of real R/C tires on real surfaces (asphalt, dirt, grass, etc.). Using the tire type you choose and the surfaces you drive on, RealRace™ continuously incorporates this actual engineering data into its simulation to provide realism in traction, steering and skidding.
- At every moment you are driving the simulator, RealRace™ accurately computes forces between the road and EACH tire. Every computation incorporates current weight transfer, surface type, orientation of tire to ground, etc.

### **Physics (Shocks/Suspension)**

- Like all parts of the car, RealRace™ uses measurements of real R/C car shocks and suspension systems to provide realism.

- It not only models shocks, but also models the mechanical configuration of the entire suspension system (length and position of suspension arms, shock angle, kick back, etc.). RealRace™ continuously updates and computes all suspension positions, angles and forces to provide the most authentic driving experience possible.

### ***Physics (Engines and Drive Train)***

- RealRace™ uses actual data to model car engines, both nitro and electric. In the simulation, the engine will deliver torque like a real engine, and will run out of fuel (or battery juice) when a real engine would.
- The drive train features realistic clutches, brakes and true differentials.
- Drive train parts are interchangeable; yet work together as they would in a real car.

### ***Physics (Steering)***

- The RealRace™ physics model uses accurate steering models (including Ackerman steering) used in real R/C cars.
- The steering angle is visible on all wheels. Wheel rotation, as well as wheel motion from shock compression, caster, and camber, is accurately displayed.

### ***Customizing Vehicles***

- Create and save your own car descriptions and parameters.
- Simple “point-and-click” menus for modifying parameters eliminate the need for difficult calculations, yet allows for authentic re-creations of actual R/C vehicles.
- Radio editing simulates a computerized car radio- including dual rates, ATV settings, servo speeds and steering exponential. Select either metric or SAE measurements.
- Over 120 editable parameters for the cars.
- View a motor performance graph for your electric motor.
- Choose one of four different color schemes for each car.

### ***Racing/Multi-player***

- Compete against opponents just like at R/C racetracks.
- Time races
- Pit stops and pit notifications
- Race against other players over the LAN, internet, or direct modem connection
- Spec racing keeps the field level and forces driving ability and car setup to determine who wins races.

---

## Technical Support

We pride ourselves in bringing you the most advanced R/C Simulator ever created. This simulator is designed to cater to people with a wide variety of multi-media personal computers and takes advantage of the latest Pentium processors to bring the action to life?

As such, there is some complexity in obtaining the optimum settings to create a perfect balance between frame rate and visual quality.

There are also some variables presented by the vast number of video cards and drivers introduced each year. To obtain assistance with any difficulty, consult our WEB site or see the “Troubleshooting” section on page 79.

Further assistance may be obtained by accessing the WEB site ([www.realrace.com](http://www.realrace.com)) or calling 217-398-8970 (option 3).

You can send email questions to [rrsupport@duratrax.com](mailto:rrsupport@duratrax.com) as well.

Be sure to include your serial number in any correspondence.

# Overviews

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## Hardware

RealRace™ is a state-of-the-art simulator. As such, there are two main types of hardware that are critical to obtaining the most from your simulation experience.

### Video Cards

Computers equipped with modern 3D cards are capable of acceleration up to 500% faster than their standard counterparts. Unfortunately, many older 3D accelerated cards cannot offer the same acceleration. To obtain the maximum performance from your RealRace™ R/C simulator, you should consider purchasing a modern 3D card. Newer 3D cards can perform much better than 1<sup>st</sup> or 2<sup>nd</sup> generation video cards. Please note, to ensure compatibility, the card must support Direct3D. Such cards may also be utilized to accelerate other popular computer games and simulations as well.

Video cards vary a great deal in speed. Retail price is rarely a fair indication as to the speed of a card. Prior to the purchase of any 3D card, we suggest that you carefully study all of the possibilities.

### *Type of Card*

There are two types of video cards: those that include only 2D acceleration and those with 2D and 3D acceleration. 2D acceleration is used to speed up operation with the Windows desktop and normal Windows applications; while 3D acceleration is used to speed up 3D games such as RealRace™.

There are many cards currently on the market which do not offer 3D acceleration. To determine whether your card supports 3D acceleration, set the 3D technology to Direct 3D. Access the **“Direct 3D”** tab through the **“Simulator Settings”** button and view the Direct3D tab options. If driver lists a "HAL Device", then your card supports 3D and you should use this device.

### *Card Options*

Some 3D accelerated cards do not support all of the rendering options listed in the Direct 3D dialog. For example, some cards do not accelerate bilinear texturing or dithering. If yours does not support a particular feature, you should turn this feature

off. This is especially important if you notice a dramatic reduction in frame rate after selecting a particular feature. Memory on the card serves several purposes. The first is to determine the actual "frame" or completed scenery is composition on this memory. This means that higher resolutions will require larger amounts of RAM. Here are some examples of how much memory you need if you want to run at the following resolutions.

Width	Height	Bit Depth	Internal Technology	Direct 3D Technology
320	240	8	154k	307k
640	480	8	616k	1.2MB
640	480	16	Not Supported	1.8 MB
800	600	24	Not Supported	3.84 MB
1024	768	8	1.57 MB	3.14 MB
1024	768	32	Not supported	7.86 MB

## Drivers

Unfortunately, just because a card supports the Direct3D technology does not mean that it supports it completely. Although problems with video cards may occur in the hardware, such difficulties are more likely to occur in the software part of the card called the "driver" or "video driver." Some manufacturers produce high quality, problem-free drivers; other manufactures produce notoriously problematic drivers. If you notice problems with the rendering in the Direct3D mode, you should test the driver with Microsoft's "FLY" or "TUNNEL" supplied on the RealRace™ CD-ROM. These applications are written by Microsoft and are considered benchmarks against which cards should run. If these exhibit the same problem, then you more than likely have a driver bug. We suggest that you visit the card manufacturer's WEB site to download the latest driver and see if it solves the problem. Otherwise, you should report the bug to the card manufacturer.

## Video Ram

How much video RAM do you need on your video card?

There are several things that require video RAM. See the table above for more information on how VRAM is allocated. The bottom line is that 4MB is an acceptable amount of RAM for a 3D-video card. This will let you run at 640x480x16 or 800x600x16. If you want to run at a higher resolution, you should get 8MB of RAM or an AGP card that can put textures in main RAM rather than VRAM.

Please note 8MB of RAM instead of 4MB will NOT make RealRace run faster, just at higher resolutions.

## Sound Cards

Although a sound card will not add to the performance of your RealRace™ R/C Simulator, it will greatly enhance the realism. Please note, older sound cards are not as efficient as today's models and may require more CPU time to service.

Additionally, RealRace™ supports only the digital audio capabilities of your card. It will not take advantage of any MIDI or WAV-table features your card may have.

Your sound card is usually the piece of hardware that hosts the game port that connects with your controller. This port needs to be capable of supporting a four axis controller. Most sound cards have this capability.

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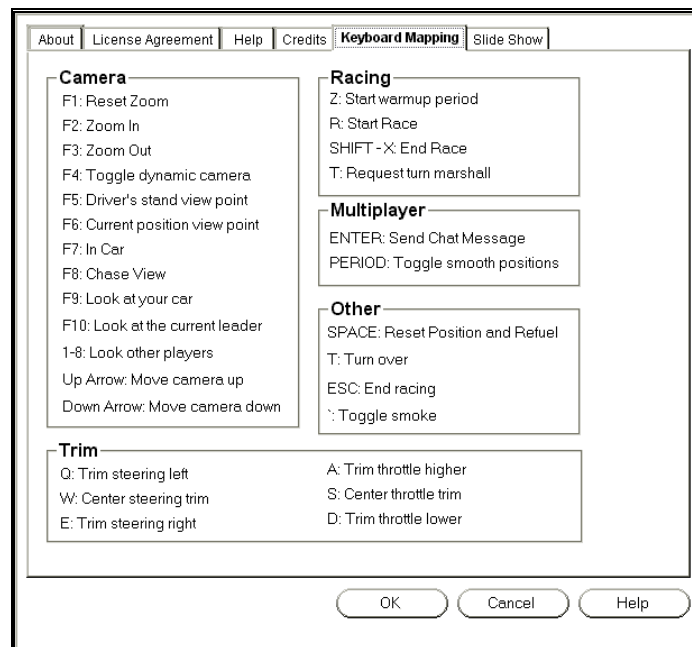
## Controller

The authentic R/C controller, produced by Futaba®, further adds to the realism thanks to its pistol grip design and authentic steering wheel.

---

## Keyboard

This page is found in the Help/Keyboard mapping page.



### Camera Keys

#### ***Function Key: F1***

Resets Zoom parameter to default setting.

#### ***Function Key: F2***

Zooms in on the car. Each time this key is pressed, zoom is increased incrementally.

#### ***Function Key: F3***

Zooms out from the car. Each time this key is pressed, zoom is decreased incrementally.

### ***Function Key: F4***

Toggles dynamic camera. This camera moves up as the car moves away and also zooms out when your car gains speed to allow a better view of the course.

### ***Function Key: F5***

Driver's stand vantage point is the view you would see when driving at the racetrack.

### ***Function Key: F6***

Takes the current position that the car is at and views the car from that position. This is the key that you should use to position yourself at various points along the track. To do so, simply drive the vehicle to the desired location and click the F6 key.

### ***Function Key: F7***

In-car, or behind the wheel, view lets you view the action as if you were inside the car.

### ***Function Key: F8***

The chase view lets you follow the action from behind the car.

### ***Function Key: F9***

View's your car.

### ***Function Key: F10***

View the leader of the race.

### ***Up Arrow***

Moves the camera upward (incrementally) to obtain an overhead viewpoint.

### ***Down Arrow***

Moves the camera downward (incrementally) to obtain a ground-level viewpoint.

## **Trim Keys**

The trim keys are useful because it may not be possible to perfectly calibrate your RealRace Controller. Also, you may prefer slight braking action when you release the throttle trigger.

### **Q**

Trims the car so that it steers more to the left.

## ***W***

Release the steering trim.

## ***E***

***Trims the car so that it steers more to the right.***

## ***A***

Trims the throttle so that the car idles faster.

## ***S***

Center the throttle trim.

## ***D***

Trims the throttle so that the car idles slower and brakes are slightly applied when the throttle is centered.

## **Racing Keys**

These keys are used during racing

## ***Z***

Starts the race warm-up period. This may only be initiated by the race Host.

## ***R***

Starts the race. This may only be initiated by the Host.

## ***SHIFT-X***

Ends the race. This may only be initiated by the Host.

## ***T***

Requests the turn marshal to turn over your car. The farther you are from the track, the longer it will take the turn marshal to turn over your car. When racing the response times may vary- just like an actual turn marshal at a race. When RealRace is utilized in the non-racing mode, the turn marshal will respond immediately.

## **Multi-player Keys**

These keys are only active in a multi-player race.

## ***ENTER***

Starts to type a chat message. Type your message and then hit “ENTER” again to send the chat message.

### **. (PERIOD)**

Toggles the use of the smooth remote players.

## **Other Keys**

### **SPACE BAR**

Resets the car position and refuels or recharges the car.

### **T**

Turns over the car.

### **ESCAPE**

Goes back to the dialogs and ends the racing.

### **` (Accent Key)**

Toggles the smoke on/off for nitro-powered vehicles.

---

## **Simulation Environment**

You can choose from a variety of racetracks, vehicles and many other environmental settings.

### **Choosing Racetracks**

RealRace™ features five lifelike racetracks.

The racetracks have many optional elements that may be turned on or off depending upon your personal preferences, and the limitations of the operating system. Please note the more elements selected the slower the simulation will run.

### **Choosing Cars**

RealRace™ offers 11 vehicles. Each car has a different appearance and a unique driving style. You should try each one of them and see how they handle.

Some cars are complex 3D models and will cause the frame rate to slow if you have a slower computer.

RealRace™ also allows you to customize car settings. The ability to edit over 120 parameters enables you to investigate changes or concepts without the hassle of building them into an actual model. The changes take place immediately and the car will reflect all changes, regardless of how minor or seemingly insignificant these might be, accordingly.

---

# Graphics and Sound Quality

Graphics and sound quality are important to your simulation experience.

## ***Frame Rate***

Frame rate is usually described as how fast the computer can compute and display a new “snapshot”. Like a movie picture, when stills are quickly flashed by, it gives the illusion of motion. Television is flickering the pictures at 30 times per second (30FPS). Your average movie theater displays about 24FPS. RealRace can produce output from 2FPS up to 70FPS.

Frame rate is a function of many things and cannot be “set” by you. It is a combination of:

- Computer Speed
- Video card speed
- Sound card speed
- How many optional race track items are selected
- Car selection

In order for the simulator to work best, you should run at a high enough frame rate so you cannot “see” the picture move from one screen to another. Rather, it should appear as a smooth motion. If you observe any “stop-and-go” motions from the simulations, there are several things you can do to improve the frame rate.

- Reduce the resolution and/or color depth (Simulator Settings\Resolution page)
- Turn off the background music (Simulator Settings\Music page)
- Use simple versions of the cars
- Turn down the track density (Racetrack selection\Terrain Editor page)
- Use lower texture resolutions (Racetrack selection\Terrain Editor)
- Turn off the random effects (Simulator Settings\Music page)
- Decrease the physics resolution (Simulator Settings\Resolution page)
- Turn off 24 Bit textures (Simulator Settings\Direct3D page)
- Turn off Transparency (Simulator Settings\Direct3D page)
- Turn of the engine smoke ( `Key)
- If the frame rate does not improve, consider buying a faster video card, or a faster computer. See [www.realrace.com](http://www.realrace.com) for video card recommendations.

## ***Sound quality***

In order to use your sound card with RealRace™, the sound card must support Microsoft’s DirectSound. There are two types of sound cards for the purposes of RealRace™.

- 8-bit sounds cards (Older cards like the old Sound Blaster cards)

- 16-bit sound cards

Many of the 16 bit sound cards now accelerate the mixing of multiple sounds. RealRace™ will take advantage of any acceleration that the card supports. This acceleration will free up your CPU thereby increasing your frame rate.

*Currently, RealRace does not support DirectSound 3D*

# Selecting Your Environment

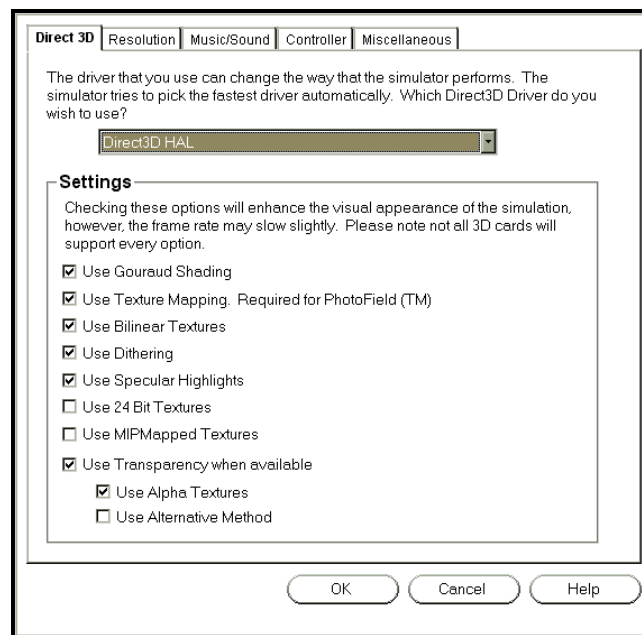
---

## Introduction

These dialog pages are designed to help you set up the details of the simulator environment. Once you have achieved the optimum performance from your PC, we suggest that you refrain from making any further changes. The idea is to get everything configured for your computer with these dialogs, then to leave these dialogs alone.

---

## Direct3D Page



### ***Technology Type***

Choose the Direct3D technology that you want to use.

- Direct3D HAL – This is the hardware accelerated driver. You should almost always use this if it appears as an option. If you do not have a

3D card installed in your computer, then this option will not be available.

- RGB – This is a software only driver that uses the RGB components of light to color the objects. The screen will look a little better, but the frame rate will be greatly slowed.

### ***Gouraud Shading***

Smoothly shades the cars and other racetrack options making them look less like polygons. This will slow down the rendering slightly. If turned off, the objects will look “flat”, yet the processing speed will increase.

### ***Bilinear Textures***

This makes the textures that are close to you, like the racecourse textures, much smoother and less “blocky.” Using this option will make the picture look nicer, but might slow down the simulation. Some cards may not support this option.

### ***Dithering***

Blends the pixels together to produce a smoother image. Using this option will make the picture look nicer, but might slowdown the simulation. Some cards may not support this option.

### ***Specular Highlighting***

This will make the paint on the car reflect the sunlight, and give the car a white “flash” at certain angles. Using this option will make the picture look nicer, but might slowdown the simulation. Some cards may not support this option.

### ***Use 24 Bit Textures***

Use 24 Bit textures when they are available. These will look nicer, but require more video RAM to implement. Some cards may not support this option.

### ***Use MipMapped Textures***

"MIPMapping" will make the textures look better and possibly draw faster assuming that your video card has enough memory. This will decrease the amount of texture "sparkling" on objects that are far away.

### ***Use Transparency When Available***

Makes objects transparent that are supposed to be transparent. For example, the exhaust will trail off as the vehicle drives away. Turning on transparency may reduce your frame rate

### ***Use Alpha Textures***

Alpha Textures is a more detailed way to do transparencies. Your card may not support this. Using Alpha Textures may reduce your frame rate.

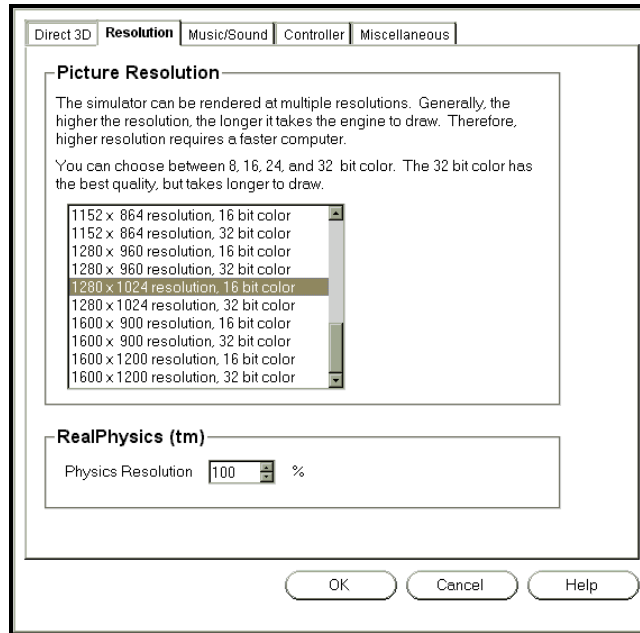
## Use Alternate Method

Some cards work better when this option is selected. If you run RealRace and you see a white background, then select this option.

---

## Resolution Page

The "Resolution" page will determine the sharpness of your picture and your physics.



## Picture Resolution

This will determine both the sharpness of the picture and how many colors will be used to render the picture. To illustrate resolution, here is the same image of a car at two different resolutions.



320 x 240 Resolution



800 x 600 Resolution

Notice how much clearer the higher resolution picture is. The problem with high resolutions is that it makes the program run slower. How much slower depends on your video card. Selecting the ideal resolution for your computer requires a delicate balance between quality and speed.

## Physics Resolution

Adjusts the speed at which the computer calculates the physics equations. Values below 100% are useful if you have a slower computer. Values above 100% are useful to get a more accurate physics response from the car.

---

## Music Page

Music and sound effects add another dimension to your simulation experience. You can choose to drive to background music or you can listen to the ambient sounds of a local driving track. If you want some random “jeering,” then turn on the random effects. If you have a slow sound card or a slow machine, you may not be able to turn on all of the sound effect options.



### Play Engine Sounds

Select whether or not to play the engine sounds. Engine sounds are an important part of the simulation; they provide you with an audible indication of car speed and distance.

You will appreciate the Doppler- correct engine sounds as your car goes screaming by you!

### Use VirtualRevolution™ Technology

VirtualRevolution™ engine technology makes the engine sound correct at both idle and full power and everywhere in between. This sounds the best, but can require more memory and will slow down the frame rate on slower computers.

### Play Background Music

Select whether or not to play CD-quality background music. This can slow down the rendering speed. Use only if you have a fast computer.

### ***Play Announcer's Voice***

Select whether or not to play announcer's voice. The announcer notifies you as to your current position when you are racing.

### ***Play List***

Select which songs and ambient background tracks to play. Click to turn songs "On" and "Off" from the play list.

### ***Random Announcements***

Frequency of the "random" sound effects. Adjust the slide bar to make them occur as frequently as you would like.

### ***Play Opening Song***

Select whether or not to play the introduction song. This will take effect the next time you start the program.

### ***Play Crash Sounds***

Select whether or not to play the crash sounds when the car crashes.

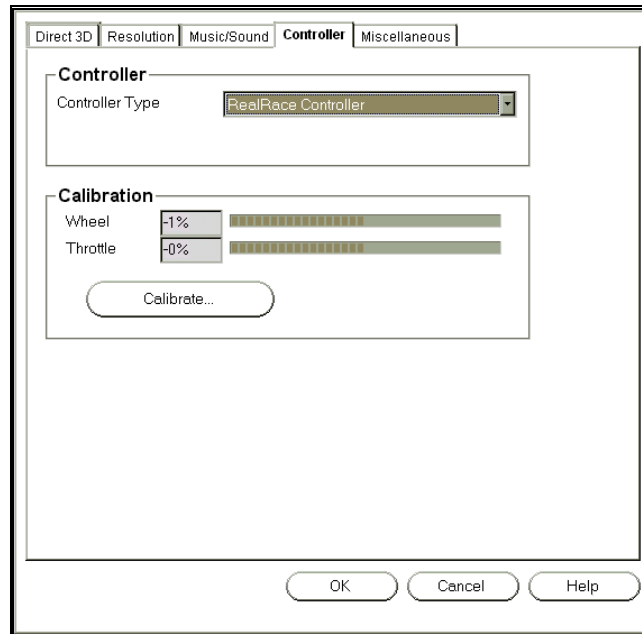
### ***Play Dialog Effects***

Select whether or not to play the sound effects while navigating the dialog boxes.

---

## **Controller Page**

This page allows you to set-up and verify your controller. It also ensures you that your controller is operating correctly. This is an important page. If your controller is not set-up correctly, the car will drive erratically.



### **Controller Type**

Choose the controller that you wish to use to control RealRace™. Most of the time, you will choose **RealRace Controller (Automatic)**.

---

## **Switch Type**

### **Calibrate**

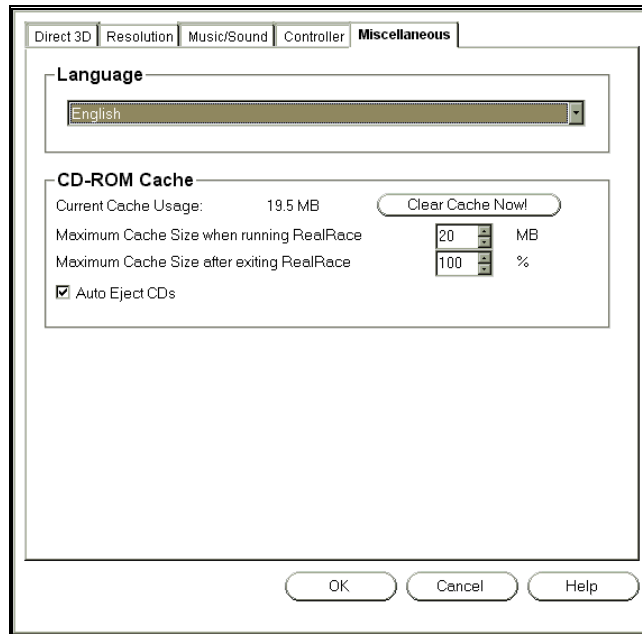
Click on the “**Calibrate**” button to initiate the calibration sequence. Follow the onscreen instructions.

*If you have difficulties getting a controller connected, visit our WEB site ([www.realrace.com](http://www.realrace.com)) for common solutions. If that is unsuccessful, call your Microsoft technical support representative or visit Microsoft's web site at <http://www.microsoft.com/DirectX>.*

---

## **Miscellaneous**

This page lets you modify some miscellaneous parameters in RealRace™.



### ***Language***

This indicates the language that RealRace™ will use in all of its message boxes and dialog boxes. Which languages appear in this combo box is dependent upon the language you selected during the RealRace™ installation program.

### ***CD-ROM Cache***

When RealRace™ reads data from the CD-ROM it keeps a copy of the data on the hard disk so the next time it needs the same data, it will be available for quick access. RealRace only keeps the most frequently used data on the hard disk. Older cached data gets deleted to make room for more frequently used data.

### ***Current Cache Usage***

Displays how much space the cache is using on your hard drive. The cache files are located in the **c:\program files\RealRace\cache** directory, assuming you installed RealRace™ in this directory.

### ***Clear Cache Now!***

Deletes all the cache files from the cache directory. You can do this any time you want to quickly free up space on your hard drive.

### ***Maximum Cache Size when running***

Limits the amount of hard drive space RealRace is allowed to use for its cache files. If you increase this amount, it will decrease the number of pauses that may occur when RealRace™ accesses the CD-ROM for more data.

### ***Maximum Cache Size after exiting RealRace***

Use this to clear out a portion of the cache directory when RealRace exists. This frees up space for other programs that you may want to run. Please note, however, the next time you run RealRace it will have to access the CD-ROM more to build the cache back up.

The percentage is a percentage of the Maximum Cache size when RealRace runs. If the Maximum size when running is 40MB and Maximum Cache size after exiting is set at 50%, the cache will be reduced to 20MB when RealRace exits.

### ***Auto Eject CDs***

When RealRace needs a new CD, it will ask for a new CD. If this check box is checked, then the CD will automatically eject. If RealRace does not seem to be recognizing your disk after you put a new one in, try turning off this option.

# Racetrack and Car

---

## Car Selection Page

Select the car you wish to drive. Options include everything from an on-road touring car to a dirt thumping monster truck. Every car or truck has its own unique driving characteristics as well as special functions.

*For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.*



### Simple Graphics

All of the cars have a complex representation and a simple representation. The simple graphics won't look as good as the complex; however, it will make the simulation run faster due to the less complicated rendering.

### **Description**

This box describes the model and any special features it may have.

### **Color Scheme**

Change the color scheme to one of four different color schemes for each car. There will be no difference in the rendering speed between the different schemes.

### **Make a Copy of Car**

RealRace™ will not allow you to modify any of the default models. It will, however, allow you to make a copy of a default car and perform modifications to the copy.

### **Delete Car**

Delete the selected car. You can only delete models that you have created. Default car may not be deleted.

### **Rename Car**

Rename the selected model. You can only rename the vehicles that you have created.

### **Full Edit/Quick Edit**

Edit the selected car. You can only edit vehicles that you have created. Therefore, it is necessary to make a copy and rename the model prior to editing.

*See “Quick Edit/Full Edit” on page 24 for further reference.*

---

## **Quick Edit/Full Edit**

Editing your car allows you to tell RealRace™ about the dimensions of your own car if you want to measure it. Or it lets you modify the performance of the existing cars. There are two ways to edit the car: Quick Edit and Full Edit. Here are the differences between the two:

<b>Full Edit</b>	<b>Quick Edit</b>
Allows you to edit every single parameter about the car.	Only allows select parameters to be edited. These are parameters that are likely to be changed on a car by a racer.
For advanced users or adventurous novices.	For Novice and Advanced users.
You will not be able to race a “Full Edited” car in a “spec race.” This prevents racers from putting a .21 engine in a .10 truck race! If the Race Manager allows unlimited racing, then you can race a car that has been modified using the Full Edit feature.	Vehicles that have been modified using the Quick Edit feature may be utilized in either a “spec” Race or an Unlimited Race.

See the “Car Editing” section on page 29 for more information on editing cars.

---

## Selecting the Race track

RealRace offers 5 lifelike racetracks to choose from.



### **Racetrack Selection**

Select driving site. Each site offers a different driving experience and a unique set of challenges for drivers of various skill levels

### **Show Shadows**

Whether to show shadows that the 3D objects generate. This will look better but slows down the rendering speed slightly. *This affects only the optional racetrack items. The shadow for the car will always be shown.*

### **Additional Racetrack Options**

Indicates which items will appear at the driving site. More items will enhance the realism but may slow down the rendering speed.

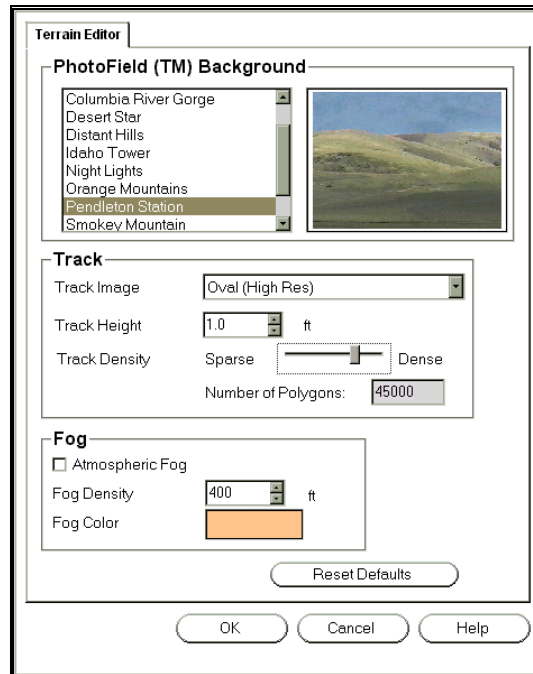
### **Edit Terrain**

Choose the Terrain options for this racetrack.

---

## Terrain Editor

The Terrain Editor lets you customize the racetrack settings. Please note that not all the options may be adjusted to their highest settings if you have a slower computer. To do so, might dramatically decrease the frame rate of the simulation.



### ***PhotoField™ Background***

Choose the background panorama for the racetrack.

### ***Track Image***

Adjusts the texture quality of the track. Slower computers may have to use lower resolution settings.

### ***Track Height***

Adjusts the highest point of the track. Increase or decrease the jump sites in the off-road tracks.

### ***Grid Density***

Adjusts the polygon density of the racetrack. A sparse density will create more jagged jumps. A dense setting will create smooth jumps; however, it will slow down the rendering speed. The visual quality of the track is completely independent of the actual ground that the car “sees”.

### ***Number of Polygons***

Displays the number of polygons that landscape will use. This is directly related to the grid density. Be aware that more polygons may slow down your frame rate.

### ***Atmospheric Fog***

Select whether or not to use fog in the scene. Distant objects will fade to the specified fog color. **IMPORTANT:** Not all 3D cards support fog.

## ***Fog Density***

Indicates the distance at which all items are completely hidden by fog.

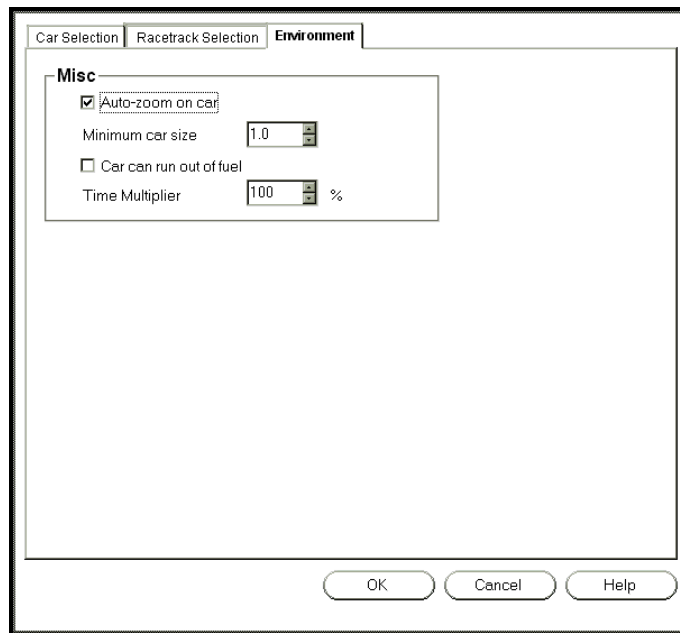
## ***Fog Color***

Specifies the fog color. Normally, this is white but you can use colored backgrounds to create special effect such as sunsets.

---

# Environment Page

This page contains some miscellaneous parameters for adjusting the RealRace™ simulation.



## ***Auto-Zoom on Car***

Prevents the model from becoming too small to see. This attempts to solve the inherent problem of trying to show a big picture of the world on a lower resolution monitor. In reality, you will be able to drive your car farther away from you and still see it well enough to drive it. With the simulator, the resolution of the monitor quickly turns the model into a few pixels. Although, setting the resolution to a higher value will relieve this problem somewhat.

Auto-Zoom will “zoom in” like a video camera as your model starts to get out of the simulation’s visual range. Unfortunately, this has the side effect of making the background panoramas look progressively more pixilated.

Try driving with and without this option turned on and see which way you like it better.

### ***Minimum Car Size***

Minimum size that the model will appear when driving. Clicking “F1” while driving will restore the car to this size. Larger values will cause the simulator to “zoom in” on the model making it appear larger. This will also reduce the peripheral view of the track.

### ***Car Can Run Out of Fuel***

Select whether or not the model runs out of fuel. This is a very real part of driving. After driving for a while, the car will eventually run out of fuel and you will have to make a “pit-stop” replenishing your fuel supply.

### ***Time Multiplier***

Percentage to adjust the physics time base. A percentage lower than 100% will make your car appear to drive slower, while a percentage greater than 100% will make your car appear to drive faster.

# Car Editing

---

## Introduction

RealRace™ allows you to create and modify your own cars. Using its exclusive RealPhysics™ technology, RealRace™ takes the actual physical description of the car and models the physics using that information. There are many variables that can affect a car's performance.

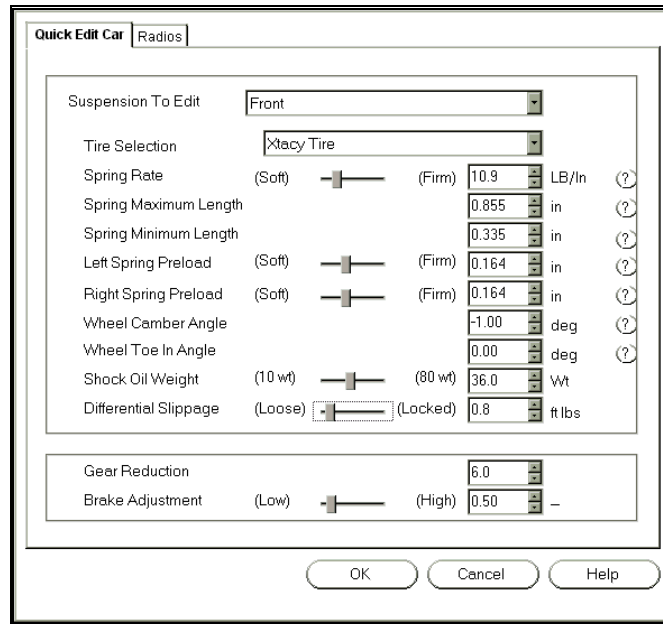
*For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.*

---

## Quick Edit

Quick Edit allows you to quickly edit some of the more common parameters of the car. To determine the differences between a “Quick Edit” and a “Full Edit” please see the “Quick Edit/Full Edit” explanation on page 24.

*For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.*



### ***Suspension to Edit***

Choose either the front or rear suspension. The edit parameters will then reflect this change.

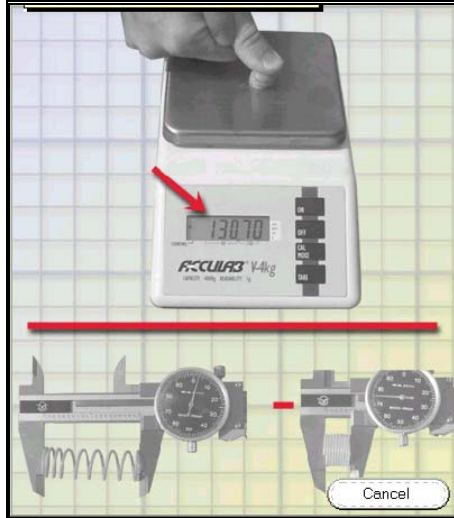
### ***Tire Selection***

Choose the tire you want.

### ***Spring Rate***

Amount of force the spring exerts per inch of travel. Stiffer springs may be better for rough tracks while softer springs are better for smoother tracks. One way you can measure this is by putting the spring on a postage scale and pushing down on the spring exactly one inch. The reading on the scale is the value you enter here.

The other way is to push the spring into the postage scale until the spring is almost completely compressed, then divide by the distance the spring traveled to get to that fully compressed position.



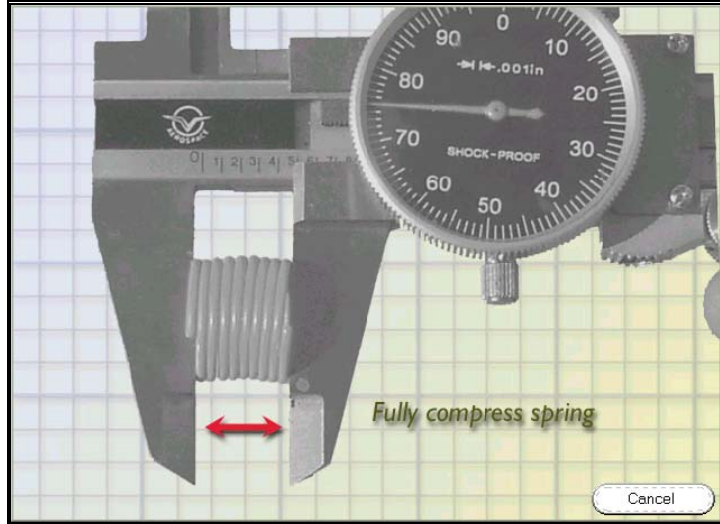
### **Spring Maximum Length**

This is the length of the spring when it is completely uncompressed.



### **Spring Minimum Length**

This is the length of the spring when it is fully compressed.



### ***Left Spring Preload***

This is the amount of spring “preload” in the left shock. This is the amount the spring position has traveled down from its weakest position on the shock. Use this to adjust the ride height of the car.



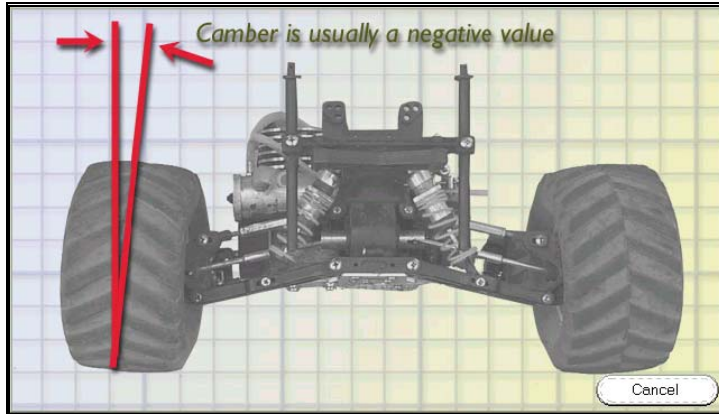
### ***Right Spring Preload***

This is the amount of spring “preload” in the right shock. This is the amount the spring position has traveled down from its weakest position on the shock. Use this to adjust the ride height of the car.



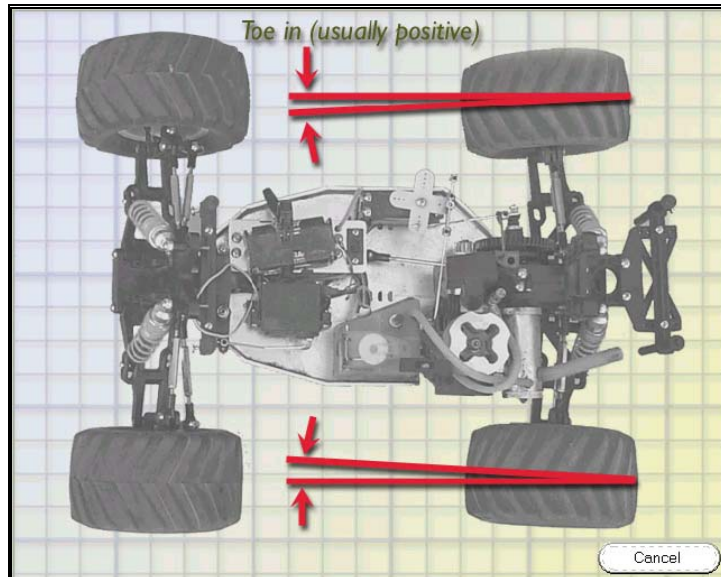
### ***Wheel Camber Angle***

Wheel camber is the amount of inward tilt of the wheels. You generally want between 1-3 degrees here. Camber is almost always negative.



### **Wheel Toe- In Angle**

Indicate the amount of toe- in. More toe- in will increase stability but will probably decrease the turning ability of the vehicle.



### **Shock Oil Weight**

This is the weight of the shock oil in the shock. Increasing the weight will make the suspension stiffer for big jumps, but will decrease traction for small bumpy tracks. This may not exactly match what you have in your car as the amount of dampening is also dependent upon shock piston size and the shock piston hole size, which RealRace™ does not model.

### **Differential Slippage**

Adds slippage if you have a ball differential. This can also be used to simulate a slipper clutch. Loosen the differential to keep the wheels from spinning out under high acceleration and to reduce current draw from batteries during acceleration.

## ***Gear Reduction***

This is the amount of gear reduction in the whole car. A gear reduction of 7.8, for example, would mean that the motor completes 7.8 revolutions for every one revolution of the wheels. If the vehicle is equipped with a two-speed transmission, this selects the gear reduction for the first gear.

## ***Brake Adjustment***

Amount of maximum braking available. Too much braking can cause the wheels to lock up while braking.

---

# Car Setup

There is some fundamental information about the car listed here. **Note:** This page and its respective dialog boxes will not appear unless you have copied a model and chosen to modify its parameters accordingly.

*This page is only available when you are using the “Full Edit” feature. To determine the differences between a “Quick Edit” and a “Full Edit”, see “Quick Edit/Full Edit” on page 24.*

*For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.*

The screenshot shows the 'Car Setup' dialog box. At the top, there are tabs for 'Shocks', 'Tires', 'Aerodynamics', 'Misc', and 'Radios'. Below these are sub-tabs for 'Car Setup', 'Suspension', 'Differentials', 'Engines', 'Clutch/Transmission', and 'Wheel Alignment'. The 'Car Setup' sub-tab is selected. The 'General Description' section has a 'Car Name' field containing 'Xtacy 2' and a 'Description' text area containing '1/10th scale, 4 wheel drive on-road touring sedan. Powered by modified'. The 'Units' section has two radio buttons: 'Standard' (which is selected) and 'Metric'. To the right of the text fields is a 3D rendering of a white and black racing car with 'TEPO' branding on the front and a checkered floor background. At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Help'.

## ***Car Name***

This name reflects the name you have chosen in the previous dialog box. We strongly suggest that you individually rename each car that you modify. This will prevent you from confusing like cars.

### **Description**

You can put your own comments here describing the cars you are creating and their respective modifications. This is ideal for modelers having several different models each with the same visual appearance.

### **Units to use**

RealRace™ is capable of using both metric and SAE units of measure. This setting will affect measurements in many pages.

#### **Standard (SAE)**

Select this option to use English units when editing the car.

#### **Metric**

Select this option to use metric units when editing the car.

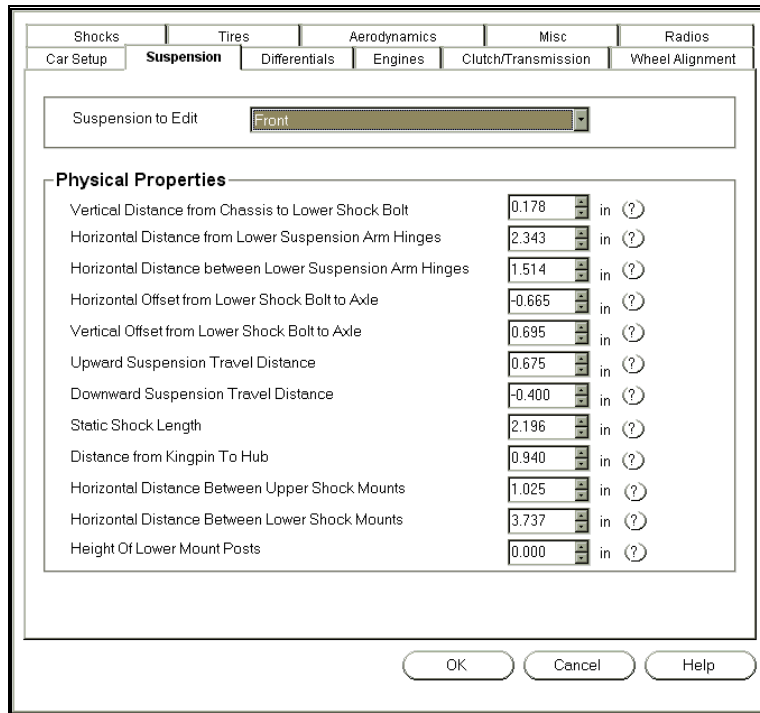
---

## **Suspension Page**

This page lets you modify the suspension geometry. You should refrain from modifying any of the values here as small changes can cause the car to suddenly behave badly. This page is designed for measuring the dimensions of your own car. When you do measure your own car, be *very, very* careful to make accurate measurements. Even errors as low as 1/10 of an inch can cause the car to behave badly.

*This page is only available when you are using the “Full Edit”. For the differences between a Quick Edit and a Full Edit, see “Quick Edit/Full Edit” on page 24.*

*For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.*

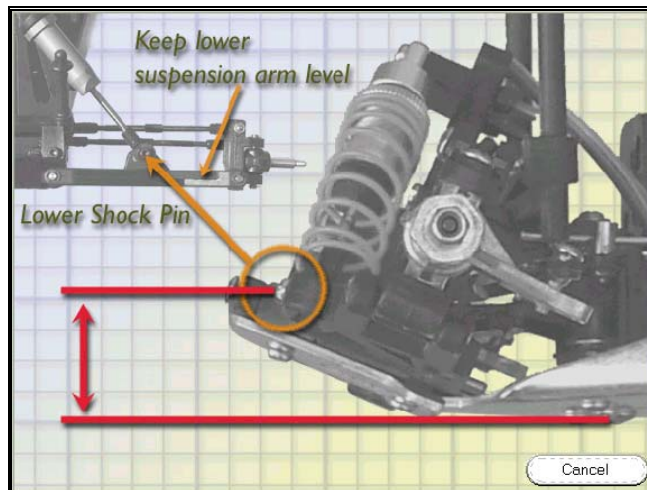


### ***Suspension to Edit***

Choose either the front or rear suspension. The edit parameters will then reflect this selection.

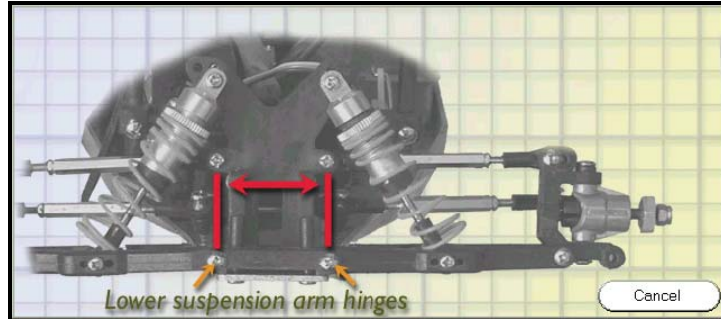
### ***Vertical Distance from Chassis to Lower Shock Bolt***

Vertical distance from the lower shock bolt to the bottom of the main chassis. If there is kick up present, then measure to the bottom of the flat portion of the chassis.



## ***Horizontal Distance between Lower Suspension Arm Hinges***

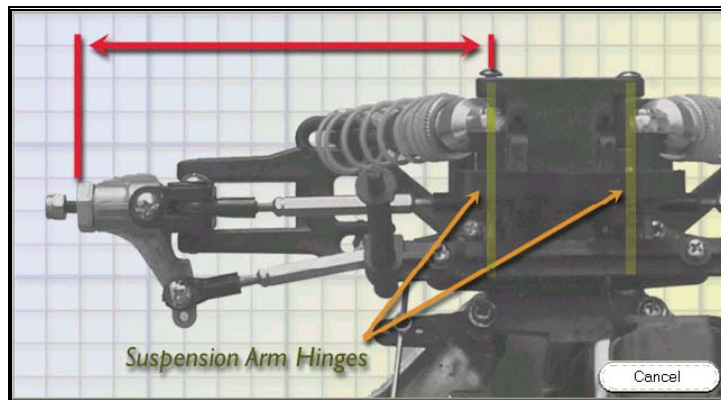
This is the horizontal distance between lower suspension arm hinges as seen from directly in front of the car.



## ***Horizontal Offset from Lower Shock Bolt to Axle***

Horizontal offset from lower shock bolt to axle. Make sure that you are looking straight at the suspension arms and not necessarily the car. (This is important if there is kick-up present). Then draw an imaginary line through the lower shock pins. Measure the distance from this line to the wheel hub.

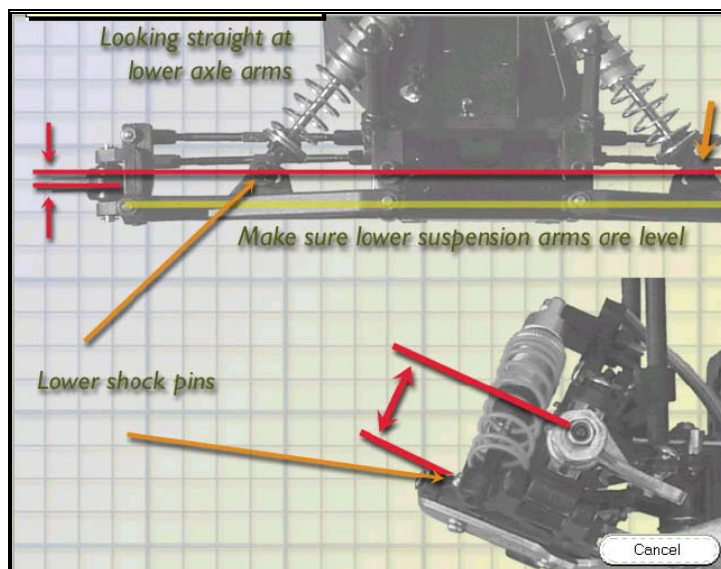
If the shock pins are in front of the hub, then the value is negative. If the shock pins are behind the hub, then the value is positive.



## ***Vertical Offset from Lower Shock Bolt to Axle***

Vertical offset from lower shock bolt to axle. Make sure you are looking straight at the suspension arms and not necessarily straight at the car. (This is important if there is kick-up present). Then make sure the suspension arms are level. Draw an imaginary line through the lower shock pins. Measure the distance from this line to the wheel hub.

If the shock pins are in below the hub, then the value is positive. If the shock pins are above the hub, then the values are negative.



### ***Upward Suspension Travel Distance***

Vertical distance the hub can travel upwards from level. Make sure the shock is not attached to the car. Also make sure that you are looking straight at the suspension arms and not necessarily straight at the car. (This is important if there is kick up present). Then make sure the suspension arms are level.

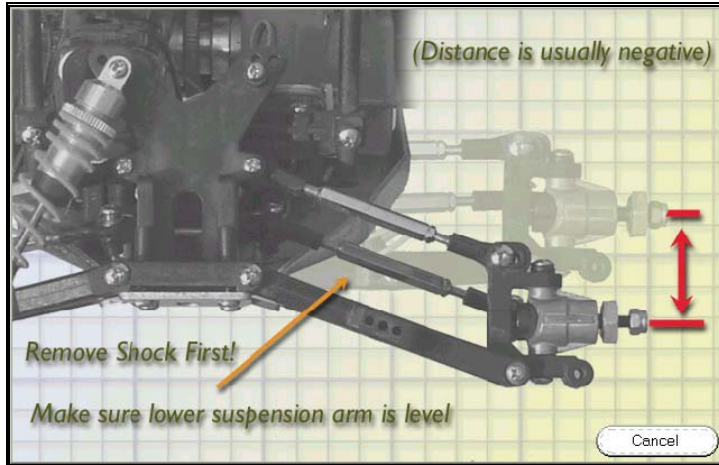
Hold a ruler to the hub. Now move the suspension arm up to its highest possible position and note the change in distance with the ruler. Enter this distance in the dialog box.



### ***Downward Suspension Travel Distance***

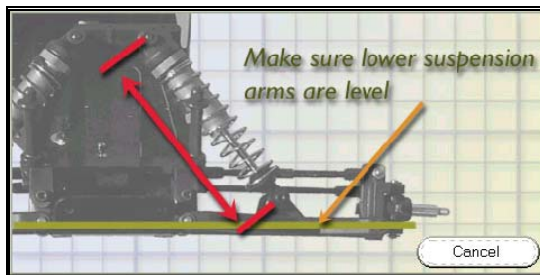
Vertical distance the hub can travel down from level. Make sure the shock is not attached to the car. Also make sure that you are looking straight at the suspension arms and not necessarily straight at the car. (This is important if there is kick up present). Then make sure the suspension arms are level.

Hold a ruler to the hub. Now move the suspension arm up to its lowest possible position and note the change in distance with the ruler. Enter that distance.



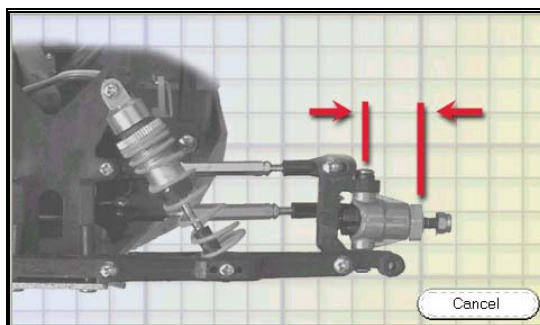
### Static Shock Length

This is the distance between the upper and lower shock pin with the suspension arm held level. Make sure you are looking straight at the suspension arms and not necessarily straight at the car. (This is important if there is kick-up present). Then make sure the suspension arm is level. Measure the distance from the lower to the upper shock pin.



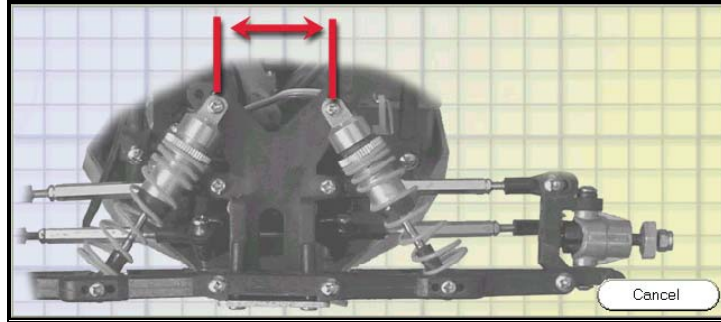
### Distance From Kingpin To Hub

Horizontal offset from kingpin the wheel hub. Make sure that you are looking straight down on the suspension arms and not necessarily the car. (This is important if there is kick-up present). Then measure the distance from the kingpin to the wheel hub.



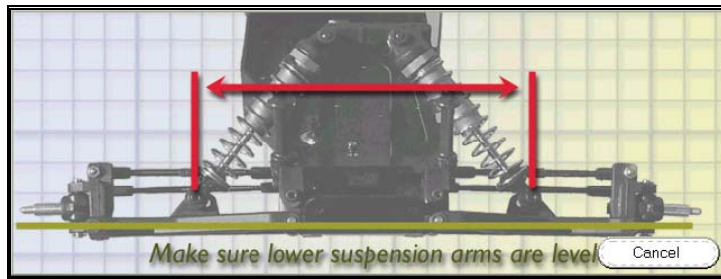
### ***Horizontal Distance Between Upper Shock Mounts***

This is the distance between the upper shock pins if looking straight at the car.



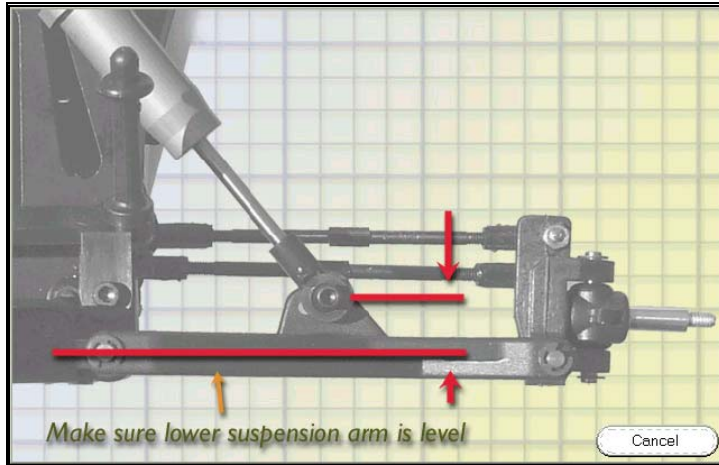
### ***Horizontal Distance Between Lower Shock Mounts***

Distance between the lower shock pins. Make sure that you are looking straight at the suspension arms and not necessarily straight at the car. (This is important if there is kick-up present). Then make sure the suspension arms are level. Now measure the distance between the axle pins.



### ***Height of Lower Mount Posts***

Distance from the center of the suspension arm to the lower shock pin. On most cars this will be zero. But on some cars there will be a post the shock mounts to. Make sure that you are looking straight at the suspension arms and not necessarily straight at the car. (This is important if there is kick up present). Then make sure the suspension arms are level. Now measure the distance between the center of the suspension arm and the lower shock pin.



## Differential Page

This page lets you modify some of the drive train elements.

*This page is only available when you are using the “Full Edit”. For the differences between a Quick Edit and a Full Edit, see “Quick Edit/Full Edit” on page 24.*

*For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.*

Shocks	Tires	Aerodynamics	Misc	Radios	
Car Setup	Suspension	<b>Differentials</b>	Engines	Clutch/Transmission	Wheel Alignment

**Drive Type**

Rear Wheel Drive
  Four Wheel Drive

**Center Differential**

Car Has Center Gear Differential  
 Differential Grease (Thin)  (Thick) 0.000 ft lbs

**Front and Rear Differentials**

Axle: Front

Gear Differential
  Ball Differential  
 Differential Grease (Thin)  (Thick) 0.000 ft lbs  
 Differential Slippage (Loose)  (Locked) 4.1 ft lbs

**Drive Train**

The drive train friction is precalculated for car type, but you can modify the value here: 40 %

OK Cancel Help

### Drive Type

- Rear Wheel Drive – Only the rear two wheels are powered by the motor.

- Four Wheel Drive – All four wheels are powered by the motor

### **Car Has Center Gear Differential**

Select whether the car has a center differential. This is only a valid choice if the car is a 4WD.

### **Differential Grease**

Adjusts the weight of the grease inside the center differential. A higher value will make it behave more like a true 4WD.

### **Axle**

Choose either the front or rear suspension. The edit parameters will then reflect this selection.

### **Differential Type**

- Gear Differential – Typical in lower end cars. Does not allow you to adjust the differential slippage
- Ball Differential – Used in higher end cars. Allows you to adjust the differential slippage.

### **Differential Grease**

Adjusts the weight of the grease inside the axle differential. A higher value will cause less of a 'differential' reaction and be more like a solid axle.

### **Differential Slippage**

Adds slippage if you have a ball differential. This can also be used to simulate a slipper clutch. Loosen the differential to keep the wheels from spinning out under high acceleration and to reduce current draw from batteries during acceleration.

### **Drive Train Friction**

Adjusts the amount of friction in the drive train. This is precalculated for this particular car, but you can modify the percentage here.

---

## **Engines Page**

This page lets you modify the power plant that you use for your car.

*This page is only available when you are using the “Full Edit”. To determine the differences between a “Quick Edit” and a “Full Edit”, see “Quick Edit/Full Edit” on page 24.*

*For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.*

## Internal Combustion Engine (Nitro!)

Shocks	Tires	Aerodynamics	Misc	Radios	
Car Setup	Suspension	Differentials	<b>Engines</b>	Clutch/Transmission	Wheel Alignment

**Motor Type**  
These settings apply to the entire car, not a particular engine.  
Power Plant:

**Fuel**  
Fuel Tank Size:  oz      Fuel Consumption:  oz/min

**Attributes**  
Sound Profile:   
Torque Curve:

OK    Cancel    Help

## Electric Motor Option

Shocks	Tires	Aerodynamics	Misc	Radios	
Car Setup	Suspension	Differentials	<b>Engines</b>	Clutch/Transmission	Wheel Alignment

**Motor Type**  
These settings apply to the entire car, not a particular engine.  
Power Plant:

**Batteries**  
# Cells:      

**Attributes**  
Sound Profile:   
Type:   
Advance Timing:  Deg     

OK    Cancel    Help

### **Power Plant**

Select whether to use an internal combustion engine or an electric motor.

### **Fuel Tank Size- (Nitro only)**

Select the capacity of the fuel tank.

### **Fuel Consumption- (Nitro only)**

Select the rate at which the engine consumes fuel.

### **Sound Profile**

Select the engine sound that is most like your car.

### **Torque Curve**

Select the torque curve that most describes your engine.

### **Number of Cells- (Electric only)**

Choose the number of cells in the battery.

### **Cell Type- (Electric only)**

Choose the cell type and capacity.

### **Type- (Electric only)**

Select the electric motor.

### **Advanced Timing- (Electric only)**

Choose the timing for the electric motor. Advanced timing will make the motor run faster but will be less efficient.

### **View Performance- (Electric only)**

View the performance of your electric motor. See *“Electric Motor Performance”* on page 44 for more information.

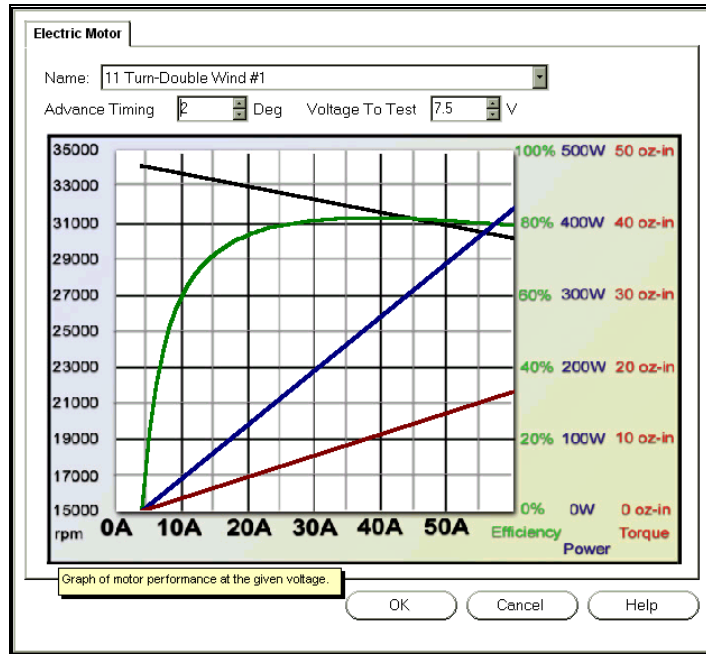
---

## **Electric Motor Performance Page**

This page lets you view the performance of the electric motor. This lets you choose the motor and timing to use for your particular application. To get the longest run time, you should try to run your motor where it is most efficient.

*This page is only available when you are using the “Full Edit”. To determine the differences between a “Quick Edit” and a “Full Edit”, see “Quick Edit/Full Edit” on page 24.*

For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.



### Name

Choose the motor you want to use for this car. The graph will display the motor's performance.

### Advanced Timing

Choose the timing for the electric motor. Advanced timing will make the motor run faster but will be less efficient.

### Voltage To Test

This determines the voltage at which to view the graph. This chart assumes that the motor is 'magically' held at this voltage at all the difference current ratings.

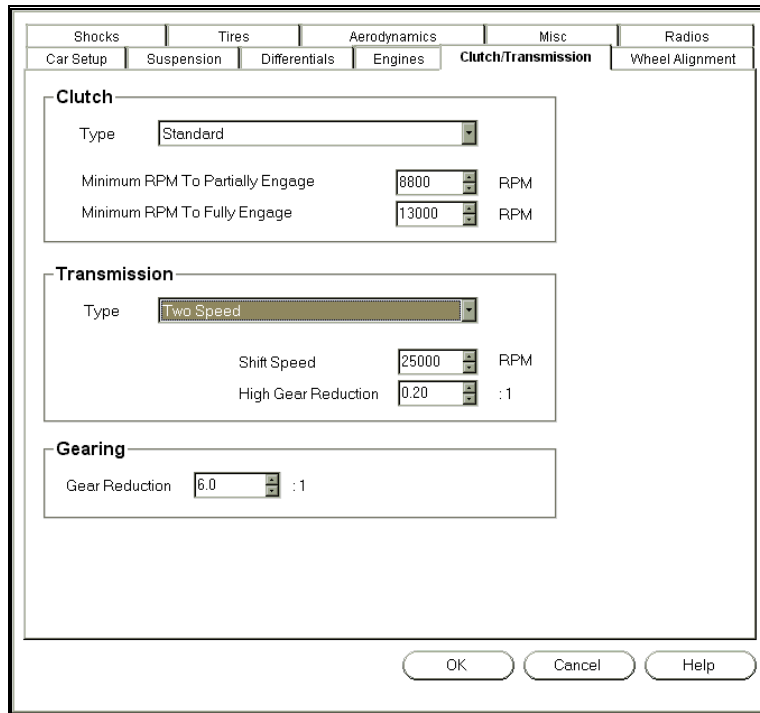
---

## Clutch/Transmission Page

This page lets you adjust the clutch and transmission in your car.

*This page is only available when you are using the “Full Edit”. To determine the differences between a “Quick Edit” and a “Full Edit”, see “Quick Edit/Full Edit” on page 24.*

For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.



### ***Clutch Type***

Choose whether the car has a clutch.

### ***Minimum RPM to Partially Engage***

RPM at which the clutch starts to engage.

### ***Minimum RPM to Fully Engage***

This is the RPM at which the clutch is fully engaged.

### ***Transmission Type***

Choose whether the car has a clutch.

### ***Shift Speed***

RPM at which the car shifts from first gear to second gear.

### ***High Gear Reduction***

The amount of gear reduction in the whole car when in 2nd gear. A gear reduction of 6.5 for example would mean that the motor completes 6.5 revolutions for every one revolution of the wheels.

### ***Gear Reduction***

This is the amount of gear reduction in the whole car. A gear reduction of 7.8 for example would mean that the motor completes 7.8 revolutions for every one

revolution of the wheels. If it has a two-speed transmission, this selects the gear reduction for the first gear.

---

## Wheel Alignment Page

This page lets you adjust the wheel alignment options for your car.

*This page is only available when you are using the “Full Edit”. To determine the differences between a “Quick Edit” and a “Full Edit”, see “Quick Edit/Full Edit” on page 24.*

*For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.*

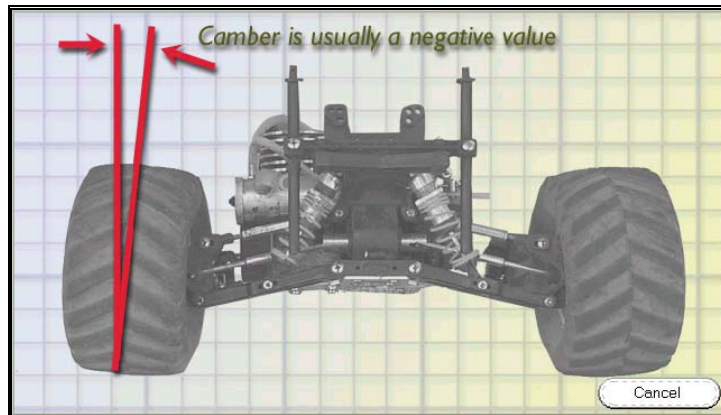
The screenshot shows a software window titled "Wheel Alignment" with several tabs: Shocks, Tires, Aerodynamics, Misc, Radios, Car Setup, Suspension, Differentials, Engines, Clutch/Transmission, and Wheel Alignment (selected). The "Wheel Alignment Parameters" section includes a dropdown menu for "Suspension to Edit" set to "Front". Below this are four rows of adjustable parameters: "Camber Angle" (value: -1.0, unit: deg), "Caster Angle" (value: 15.00, unit: in), "Toe-In Angle" (value: 0.0, unit: deg), and "Chassis Kick-up Angle" (value: 2.00, unit: deg). The "Steering" section has two rows: "Maximum Steer Angle: Wheel Turned In" (value: 24, unit: deg) and "Wheel Turned Out" (value: 23, unit: deg). The "Wheel Base" section has one row: "Wheel Base" (value: 10.25, unit: in). At the bottom of the window are three buttons: "OK", "Cancel", and "Help".

### ***Suspension to Edit***

Choose either the front or rear suspension. The edit parameters will then reflect this change.

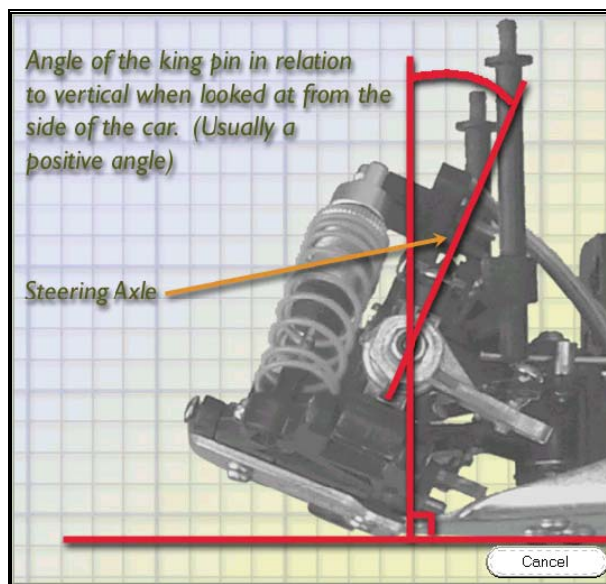
### ***Camber Angle***

Wheel camber is the amount of inward tilt of the wheels. You generally want between 1-3 degrees here. Camber is almost always negative.



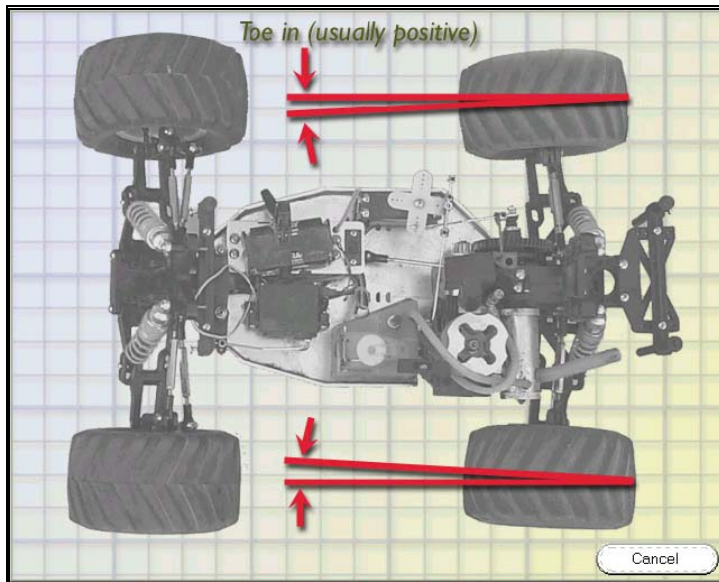
### **Caster Angle**

Adjusts the caster. This is the angle formed by the kingpin and the chassis. More caster will give you better turning when entering corners but less when exiting corners. The opposite is also true, decreasing the caster will give you less steering when entering corners but more steering when exiting turns.



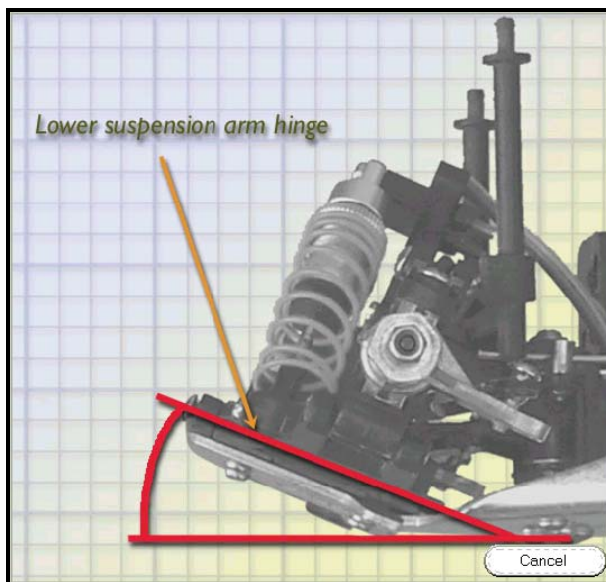
### **Toe-In Angle**

Indicate the amount of toe-in. More toe-in will increase stability but will probably decrease the turning ability of the vehicle.



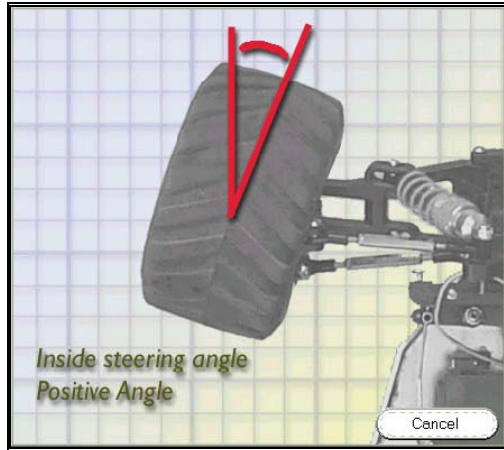
### ***Chassis Kick-up Angle***

Kick-up is the angle of the front suspension to the chassis.



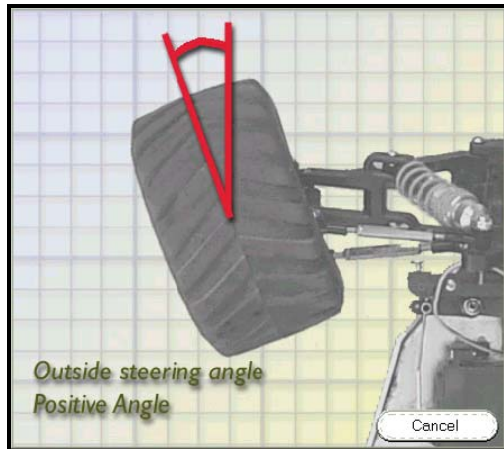
### ***Maximum Steer Angle – Wheel Turned In***

This is the angle of the tire when the tire points in towards the car. This value is always positive.



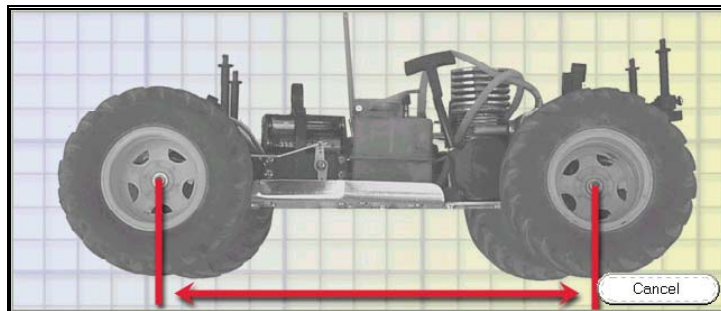
### **Maximum Steer Angle – Wheel Turned Out**

This is the angle of the tire when the tire points away from car. This value is always positive.



### **Wheel Base**

This is the distance from the center of the front tire to the center of the rear tire.



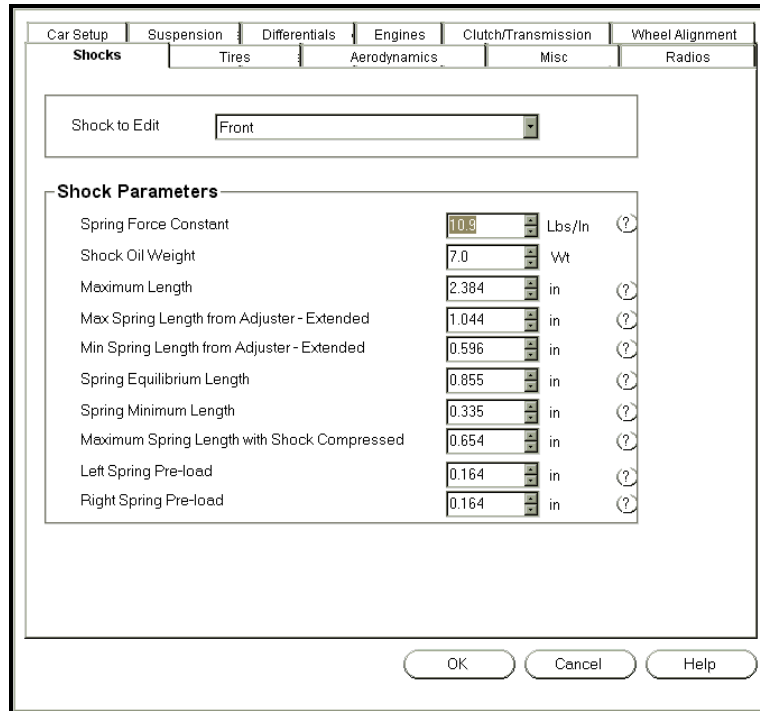
---

## **Shock Page**

This page lets you adjust the shocks for your car.

*This page is only available when you are using the “Full Edit”. To determine the differences between a “Quick Edit” and a “Full Edit”, see “Quick Edit/Full Edit” on page 24.*

*For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.*

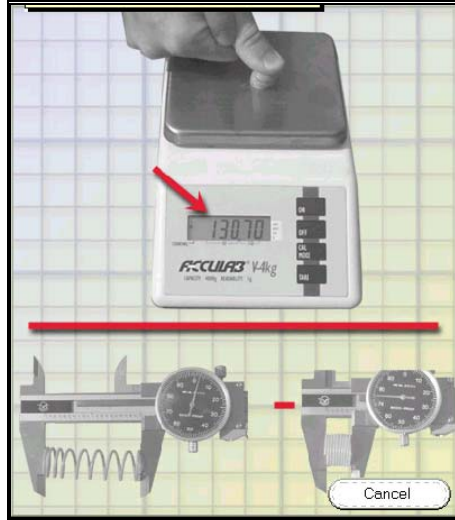


### **Shock to Edit**

Choose either the front or rear suspension. The edit parameters will then reflect this change.

### **Spring Force Constant**

Amount of force the spring exerts per inch of travel. Stiffer springs may be better for rough tracks while softer springs are better for smoother tracks. One way you can measure this is by putting the spring on a postage scale and pushing down on the spring exactly one inch. The reading indicated on the scale is the value you enter here. The other way is to push the spring into the postage scale until the spring is almost completely compressed, then divide by the distance the spring traveled to get to that fully compressed position.

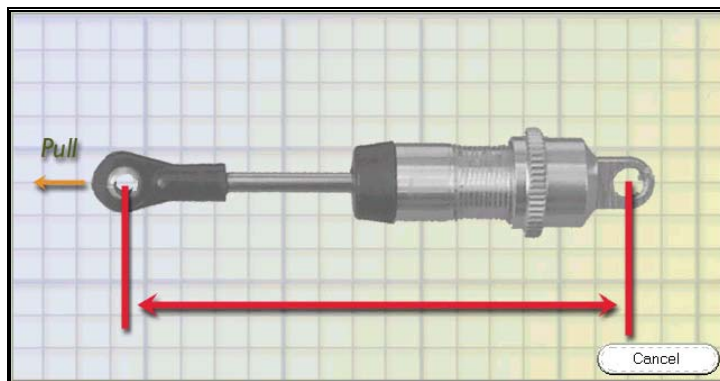


### **Shock Oil Weight**

Weight of the shock oil in the shocks. Increasing the weight will make the suspension stiffer for big jumps, but will decrease traction for small bumpy tracks. This may not exactly match what you have in your car as the amount of dampening is also dependent upon the shock piston size and the shock piston hole size, which RealRace™ does not model.

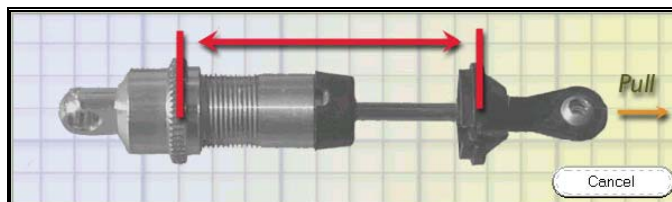
### **Maximum Length**

Length of the shock with the shock fully extended.



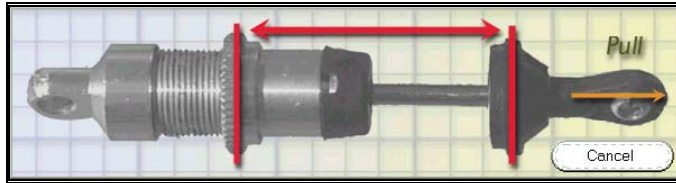
### **Max Spring Length from Adjuster – Extended**

This is the length of the imaginary spring with the shock fully extended and the spring pre-load set to the weakest value.



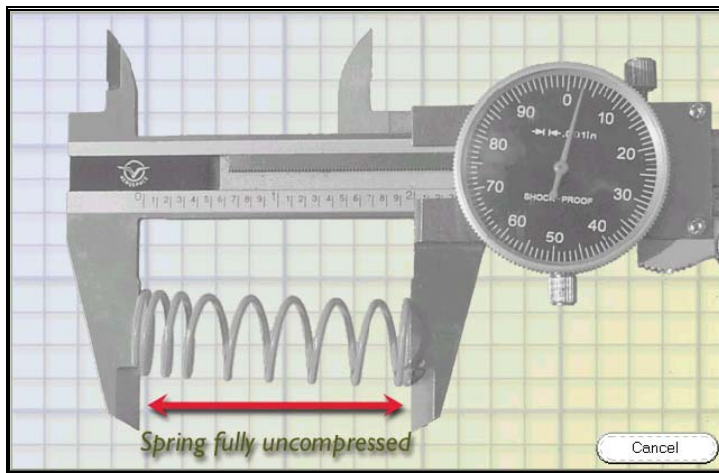
### **Min Spring Length from Adjuster – Extended**

This is the length of the imaginary spring with the shock fully extended and the spring pre-load set to the strongest value.



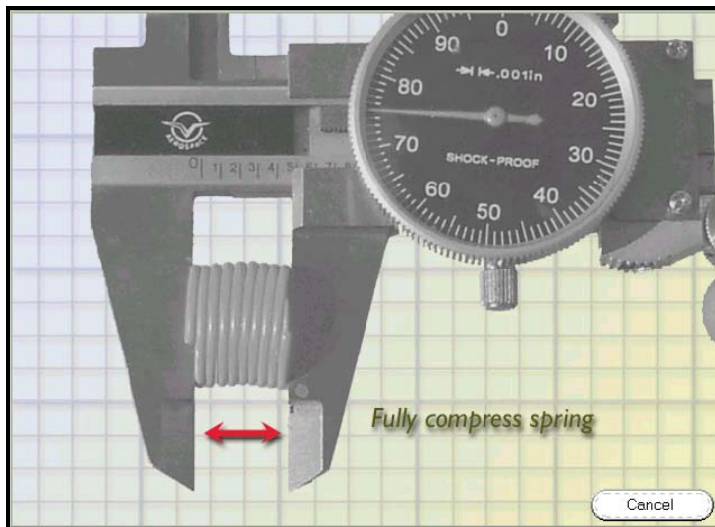
### **Spring Equilibrium Length**

This is the length of the spring when it is uncompressed. Make sure the spring is removed from the shock first.



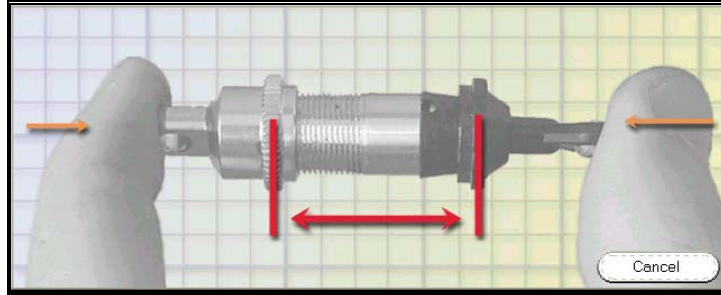
### **Spring Minimum Length**

This is the length of the spring when it is fully compressed. Make sure the spring is removed from the shock first.



### **Maximum Spring Length with Shock Compressed**

This is the length of the imaginary spring with the shock fully compressed and the spring pre-load set to the weakest value.



### **Left Spring Pre-load**

This is the amount of spring pre-load in the left shock. This is the amount the spring position has traveled down from its weakest position on the shock. Use this to adjust the ride height of the car.



### **Right Spring Pre-Load**

The amount of spring preload in the right shock. This is the amount the spring position has traveled down from its weakest position on the shock. Use this to adjust the ride height of the car.



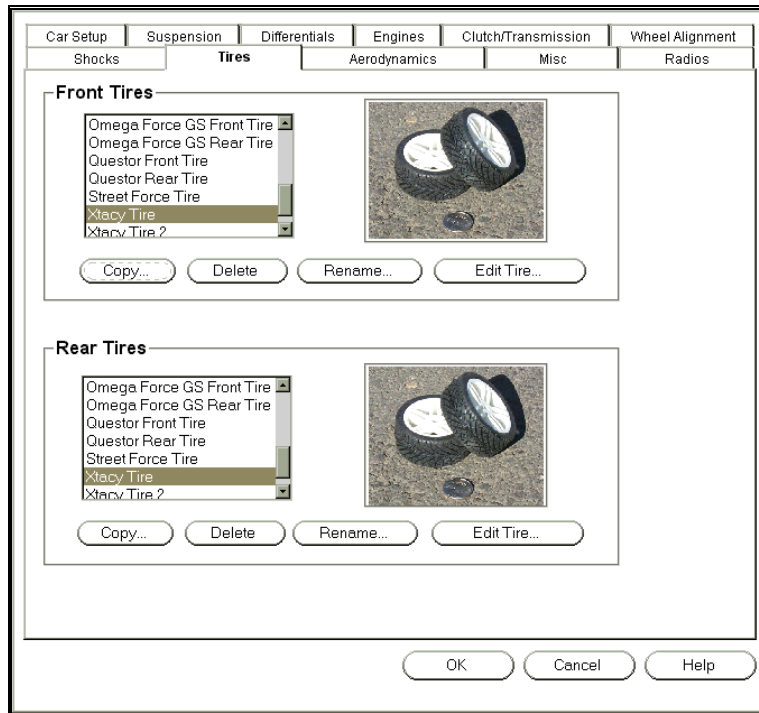
---

## **Tires Page**

This page lets you adjust which tires go on the car.

*This page is only available when you are using the "Full Edit". To determine the differences between a "Quick Edit" and a "Full Edit", see "Quick Edit/Full Edit" on page 24.*

*For More Information on tuning your R/C Car, be sure to read the "Comprehensive Guide to R/C Car Set-Up (Bonus Section!)" on page 87.*



### **Tire Selection**

Select the tires you want on the front and rear tires.

### **Copy**

Copy the tire to a new file.

### **Delete**

Delete the tire. Note this will remove the tire for all cars that are using it.

### **Rename**

Renames the tire.

### **Edit**

Edit the current tire. This will change the tire for all cars that are using the tire. See "Tire Edit Page" on page 55 for more information.

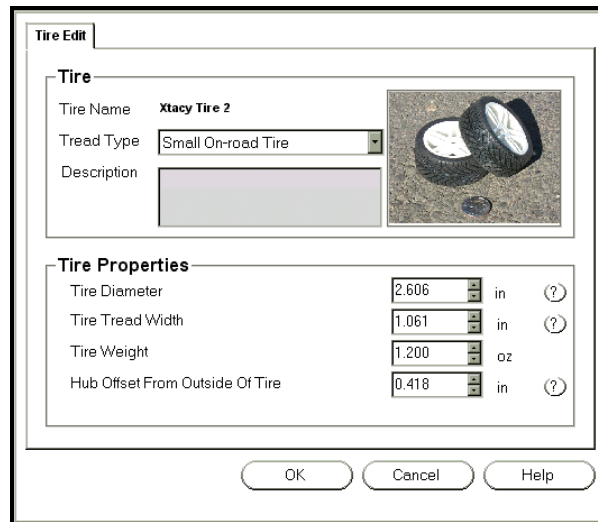
---

## **Tire Edit Page**

This page lets you adjust the dimension of the tires.

*This page is only available when you are using the "Full Edit". To determine the differences between a "Quick Edit" and a "Full Edit", see "Quick Edit/Full Edit" on page 24.*

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### ***Tire Name***

Name of the tire.

### ***Tread Type***

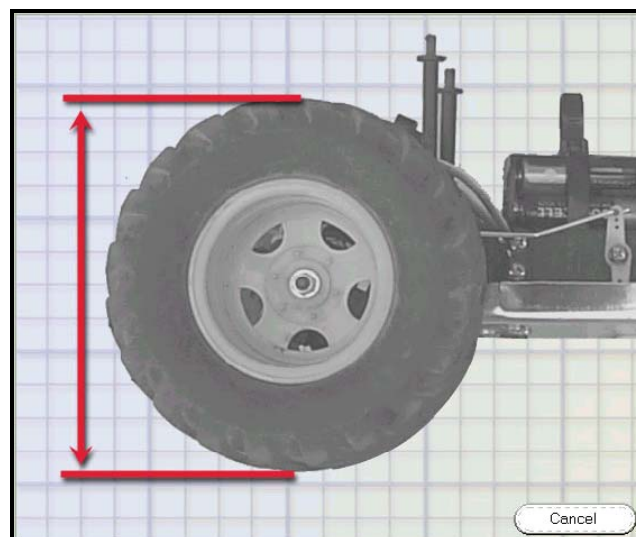
Type of tread to use. Note when choosing a tread type you should also try to match the size of the tire you are using. This will make the simulation more accurate. For instance, don't take big monster truck tires and put them on a small 2WD buggy.

### ***Description***

Description of the tread type.

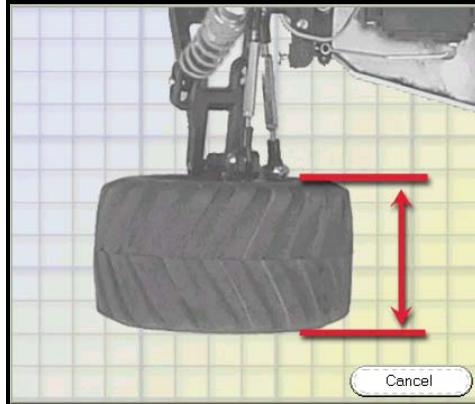
### ***Tire Diameter***

Diameter of the tire.



### **Tread Width**

The width of the tire.

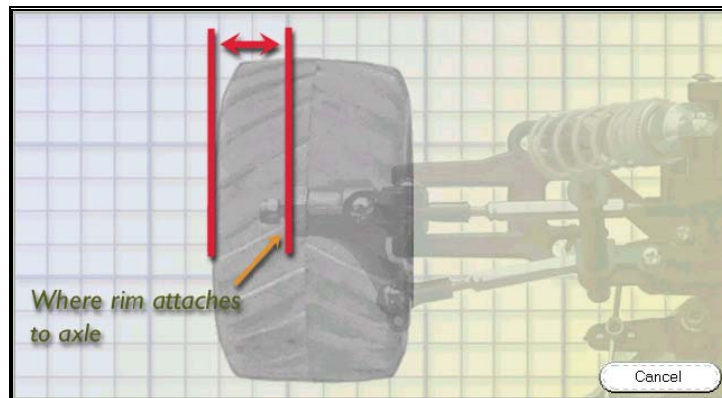


### **Tire Weight**

Weight of the tire and the rim.

### **Hub Offset from Outside of Tire**

Distance from the outside of the tire to where the hub of the car meets the rim.



---

## **Aerodynamics Page**

This page lets you adjust the aerodynamic properties of the car.

*This page is only available when you are using the "Full Edit". To determine the differences between a "Quick Edit" and a "Full Edit", see "Quick Edit/Full Edit" on page 24.*

*For More Information on tuning your R/C Car, be sure to read the "Comprehensive Guide to R/C Car Set-Up (Bonus Section!)" on page 87.*

Car Setup	Suspension	Differentials	Engines	Clutch/Transmission	Wheel Alignment
Shocks	Tires	<b>Aerodynamics</b>		Misc	Radios

**Body Aerodynamics**

Many of the aerodynamic properties are precalculated for you based on the body style of the car you are driving. You can modify some of the precalculated values here.

Frontal Drag Percent	<input type="text" value="100"/>	%	Area	<input type="text" value="6.0"/>	sq in
Downforce Percent	<input type="text" value="100"/>	%	Area	<input type="text" value="42.0"/>	sq in
Sideforce Percent	<input type="text" value="100"/>	%	Area	<input type="text" value="14.0"/>	sq in

**Fin**

Has Tail Fin

Fin Top Area	<input type="text" value="6.0"/>	sq in	(?)
Fin Side Area	<input type="text" value="1.0"/>	sq in	(?)
Fin Angle	<input type="text" value="9.0"/>	Deg	(?)
Fin Location Y	<input type="text" value="1.0"/>	in	(?)
Fin Location Z	<input type="text" value="4.0"/>	in	(?)

### ***Frontal Drag Percent***

Modify the pre-calculated frontal drag by entering a percent here. A value of 100% will use what RealRace thinks is best for this type of car.

### ***Downforce Percent***

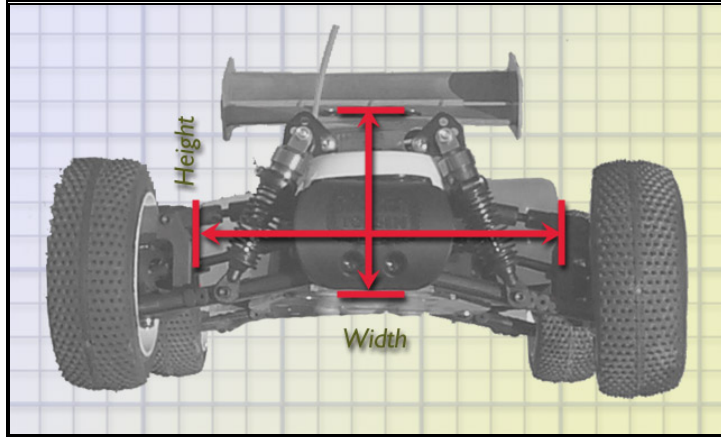
Modify the pre-calculated downforce by entering a percent here. A value of 100% will use what RealRace thinks is best for this type of car.

### ***Sideforce Percent***

Modify the pre-calculated side drag by entering a percent here. A value of 100% will use what RealRace thinks is best for this type of car.

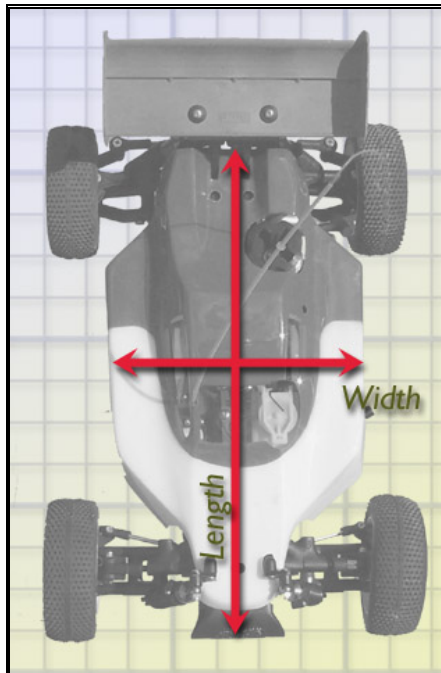
### ***Frontal Area***

This is the total area of the car when looking at the front of the car. A good way to estimate this value is to multiply the width of the car by the height of the car.



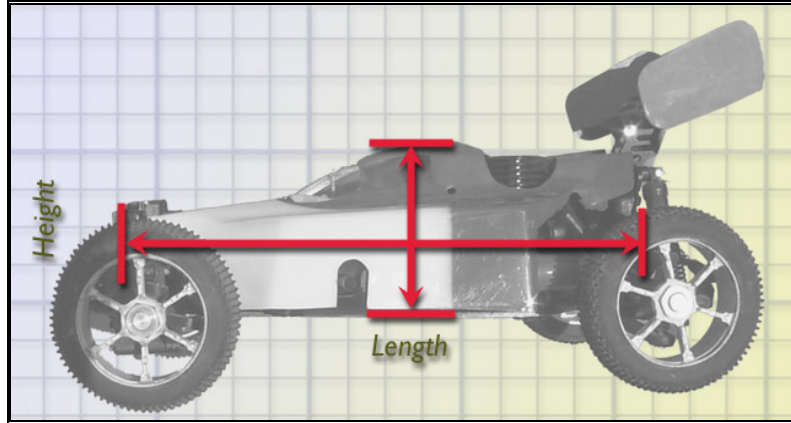
### **Top Area**

This is the total area of the car when looking at the top of the car. This value may be approximated by multiplying the length of the car by the width of the car.



### **Side Area**

This is the total area of the car when looking at the side of the car. You may approximate this value by multiplying the length of the car by the height of the car. This value should then be multiplied by 0.6.

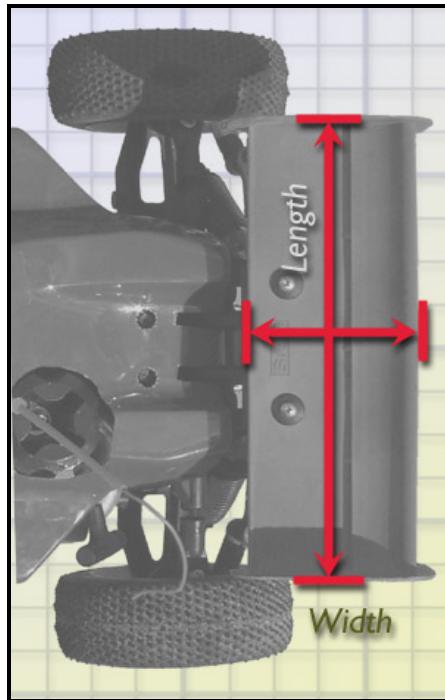


### ***Has Tail Fin***

Choose whether the car has a horizontal fin.

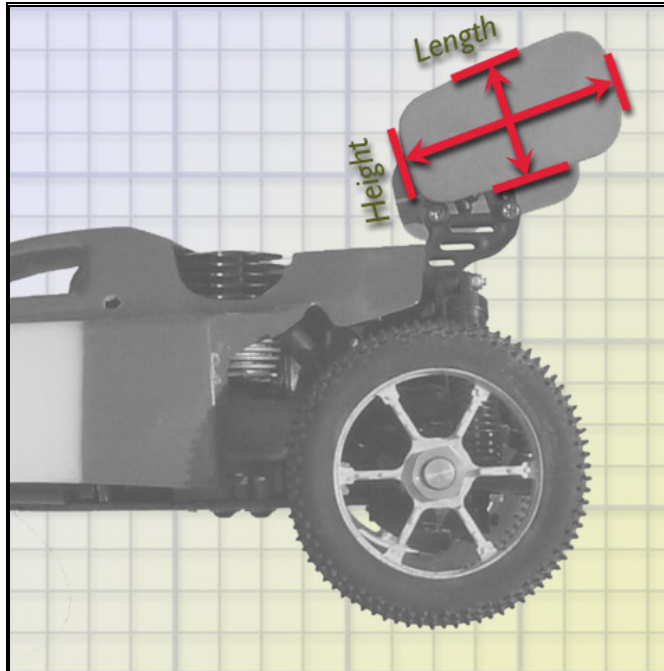
### ***Rear Wing Area***

This is the overall area of the wing when viewed from the top. This is usually determined by multiplying the length of the fin by the height.



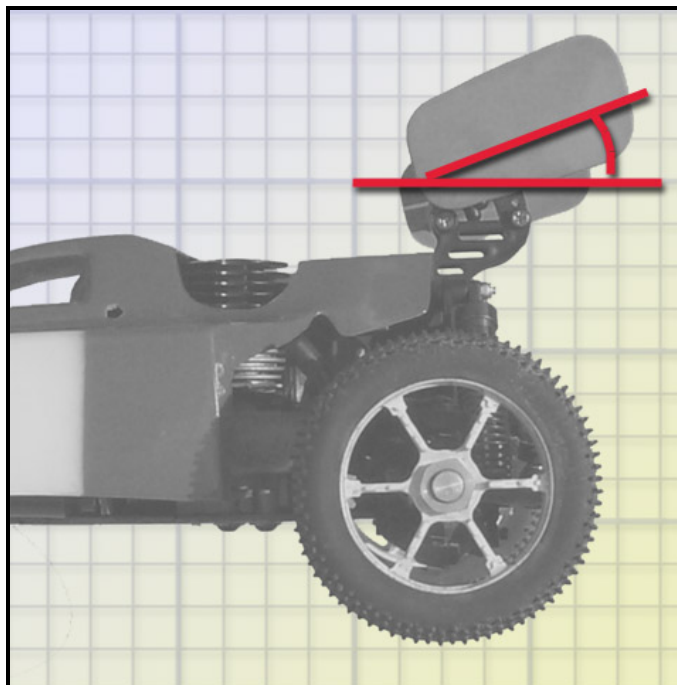
### ***Rear Wing Side Area***

This is the total area of the wing when looking at the side. If there are no vertical wing sides, then enter 0 in the dialog box.



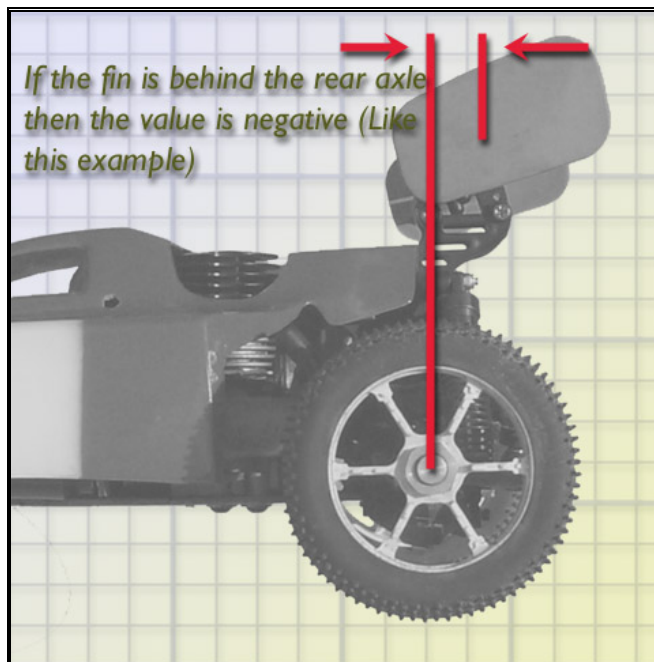
### ***Rear Wing Angle***

Enter the average angle of attack for the wing when viewed from the side. This angle will always be positive.



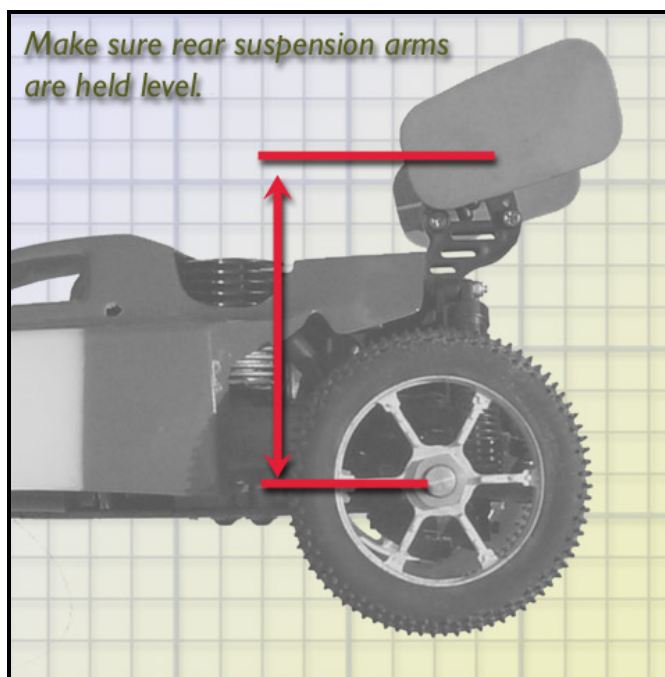
### ***Wing Location Y***

The horizontal location of the wing as measured from the center of the rear wheel. This value will be positive if the wing is in front of the center point of the rear wheel and will be negative if the wing is behind the center point.



### ***Wing Location Z***

The vertical location of the wing as measured from the center of the rear wheel. This value will always be positive.



---

## **Miscellaneous Page**

This page lets you adjust the miscellaneous properties of the car.

This page is only available when you are using the “Full Edit”. To determine the differences between a “Quick Edit” and a “Full Edit”, see “Quick Edit/Full Edit” on page 24.

For More Information on tuning your R/C Car, be sure to read the “Comprehensive Guide to R/C Car Set-Up (Bonus Section!)” on page 87.

The screenshot shows the 'Misc' tab in the R/C Simulator software. The 'Inertia' section has three spinners: Yaw (100.00%), Pitch Inertia (100.00%), and Roll Inertia (100.00%). The 'Center Of Mass Offset' section has three spinners: Right (0.00 in), Forward (5.00 in), and Up (0.80 in). The 'Brakes' section has a dropdown menu for Brake Type (Standard) and a spinner for Max. Braking Torque (0.50 Nm). The 'Weight' section has a spinner for Without Fuel (2.99 lbs). At the bottom are buttons for OK, Cancel, and Help.

### ***Yaw Inertia***

Adjusts the rotational inertia in the yaw axis.

### ***Pitch Inertia***

Adjusts the rotational inertia in the pitch axis.

### ***Roll Inertia***

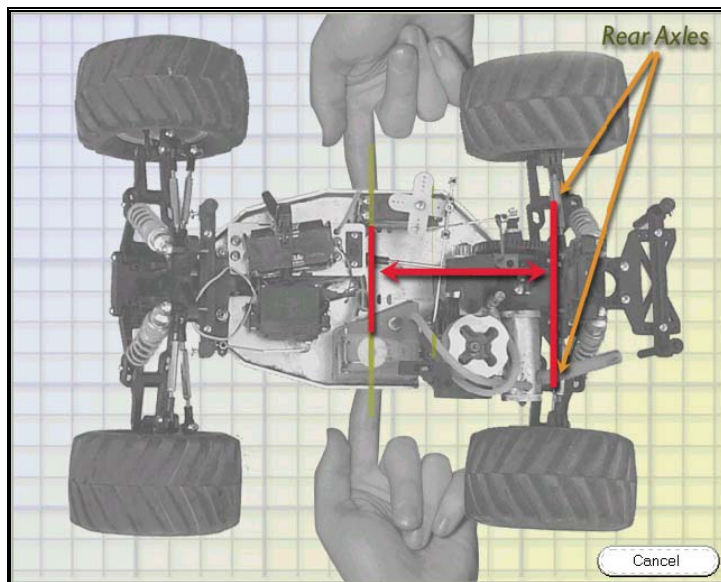
Adjusts the rotational inertia in the roll axis.

### ***Center of Mass- Right***

Right to Left location of the Center of Mass as measured from the middle of the car. This will ideally be “0” meaning that the car is balanced directly on center.

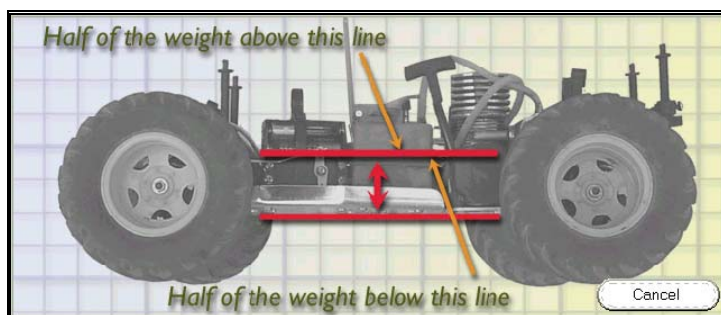
### ***Center of Mass – Forward***

Forward Location of the Center of Mass as measured from the rear axle. This will always be a positive value. You can measure this value by finding the point where the car balances on your fingertips.



### **Center of Mass – Up**

Upward location of the center of mass as measured from the chassis floor. You can measure this by hanging the car from its front wheels by a string. If you were to continue a line down from the string through the car, it would be where this line intersects the forward CG location. This will always be a positive value.



### **Brake Type**

Choose whether the car has brakes.

### **Max Braking Torque**

Amount of maximum braking available. Too much braking can cause the wheels to lock up while braking.

### **Weight with Fuel**

Weight of the car with fuel or batteries.

---

## Radio Page

This page lets you adjust the computer radio that controls your car

*This page is only available when you are using the "Full Edit". To determine the differences between a "Quick Edit" and a "Full Edit", see "Quick Edit/Full Edit" on page 24.*

Car Setup	Suspension	Differentials	Engines	Clutch/Transmission	Wheel Alignment
Shocks	Tires	Aerodynamics	Misc	Radios	

### Steering ATV Settings

Right: 100.0  
Left: 100.0

### Servo Speeds

Throttle: 0.01 sec/60 deg  
Steering: 0.01 sec/60 deg

### Steering Dual Rates

Low Rate When: Switch 1 On  
High Rate: 100.0  
Low Rate: 70.0

### Steering Exponential Rates

When: Never  
During High Rate: 100.0  
During Low Rate: 70.0

OK Cancel Help

### **Right Steering ATV**

Choose the percentage of maximum servo travel for right steering.

### **Left Steering ATV**

Choose the percentage of maximum servo travel for left steering.

### **Steering Dual Rate When**

Choose when the low rates will be activated.

### **Steering High Rate**

Amount of steering ATV to use during high rates. Normally this is 100%.

### **Steering Low Rate**

Amount of steering ATV to use during low rates. Normally this value is less than 100%.

### ***Throttle Servo Speed***

Choose the speed of the throttle servo. Normal servos are in the .15 to .25 sec/60 degree range.

### ***Steering Servo Speed***

Choose the speed of the steering servo. Normal servos are in the .15 to .25 sec/60 degree range.

### ***Steering Exponential When***

Choose when the exponential rates will be activated.

### ***Exponential during High Rate***

Amount of exponential to use when using high rates. Higher values (up to 100%) will provide softer steering around center, but more radical steering towards the end of the control throws.

### ***Exponential during Low Rate***

Amount of exponential to use when using low rates. Higher values (up to 100%) will provide softer steering around center, but more radical steering towards the end of the control throws.

# Racing

---

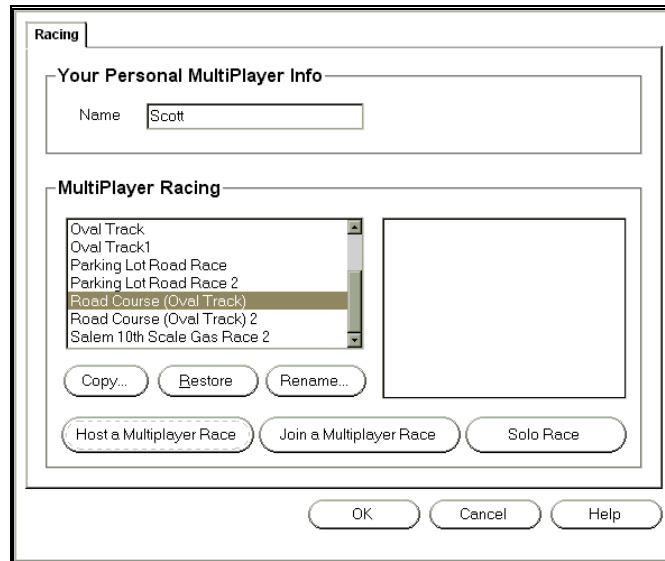
## Racing Page

For most people driving an R/C car around their backyard just isn't enough. Because of this, RealRace offers the ability to race against the clock, or against other human opponents.

If all you want to do is sharpen your driving skills, RealRace allows you to race against the clock, allowing you to be your own competitor. But if you want to improve your racing strategies, hook up a modem or network card and challenge your friends to a race. Setting up a race is easy too.

You won't see any weapons or special 'turbo' track sections either. A victory in RealRace will rely on each driver's ability to drive from the driver's stand. RealRace also includes many different race configurations that a hosting player can modify. If it's a road race you are looking for, try the Asphalt Challenge. If something off road is more your speed you can try the Dirt Bowl.

*Remember, the winner is the driver who completes to most laps in the least amount of time.*



### ***Name***

Type your name in here. You may want to consider carefully what name you use, because this is the name your competitors will see.

### ***Race Selection***

The race selection is only valid for 'multi-player' and 'solo' racing. The race you choose will determine the default track and car. Keep in mind these are the default values and can be changed. Please remember the changes will be preserved. As such, it might be beneficial to copy a race and configure the copy to your satisfaction.

### ***Copy***

Copy a race to another race file. This is helpful for creating your own race configurations and saving them.

### ***Delete***

Deletes an existing race file. You cannot delete the default settings that come with RealRace.

### ***Restore***

Restore the race to the default values the race was installed with. This will only work with the basic races that come with RealRace. You will not be able to restore races that you have copied and modified.

### ***Rename***

Renames an existing race file. You can only rename races that you have copied or created.

### **Host Multi-player**

Host a multi-player race. Select this only if other opponents are going to race with you. If you are racing by yourself, choose solo race instead. See “*Selecting Communication Channel*” on page 69.

### **Join Multi-player**

Joins an existing multi-player race. In order to join a race, someone must first be hosting a race. It is the host’s race selection that will be used. When you are joining a race the race file that you choose is ignored. See “*Selecting Communication Channel*” on page 69.

### **Solo Race**

Race solo against the clock. This configuration is helpful for acquainting yourself with one of the racetracks.

---

## Selecting Communication Channel



### **Communications Channel**

Select the service provider you and the other players are using. The service provider is the means by which your computer will connect with the other computers. Most of the time you probably use the ‘Internet TCP/IP Connection for DirectPlay’.

RealRace works best over a high-speed network (LAN). You can also dial into the Internet using a modem. In both cases you will want to use the TCP/IP option.

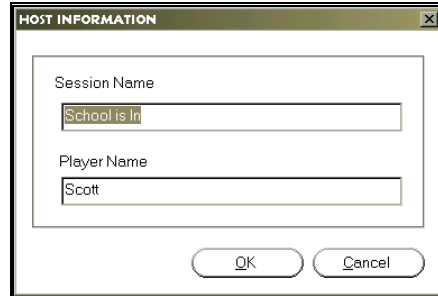
If you are dialing to a friend’s modem then you will want to use the third selection ‘Modem Connection for DirectPlay’.

- If you are hosting the next dialog you will see is the Host Information Dialog (See “*Hosting a Race*” on page 70)
- If you are joining the next dialog you will see is the Select Session Dialog (See “*Joining a Race*” on page 70)

---

# Hosting a Race

## Host Information



### **Session Name**

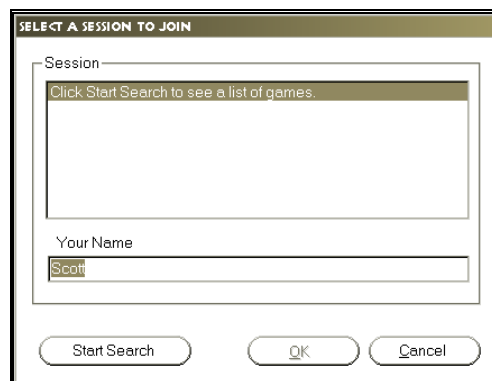
This is the name of the session that others trying to join will look for. They will be presented with a list of available sessions so it is important that the session name be one that they will easily recognize.

### **Player Name**

This is the name of your player. You may want to consider carefully what name you use, because this is the name your competitors will see.

---

# Joining a Race



### **Session**

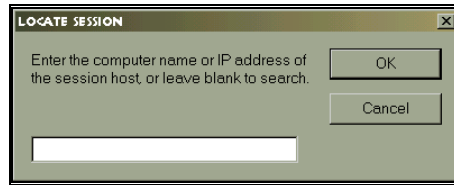
List of all the active sessions. Click on the Start Search Button to start searching for the sessions.

### **Your Name**

The name others will see when you join.

## Start Search

Start searching for sessions. You will then see a dialog that looks something like this:

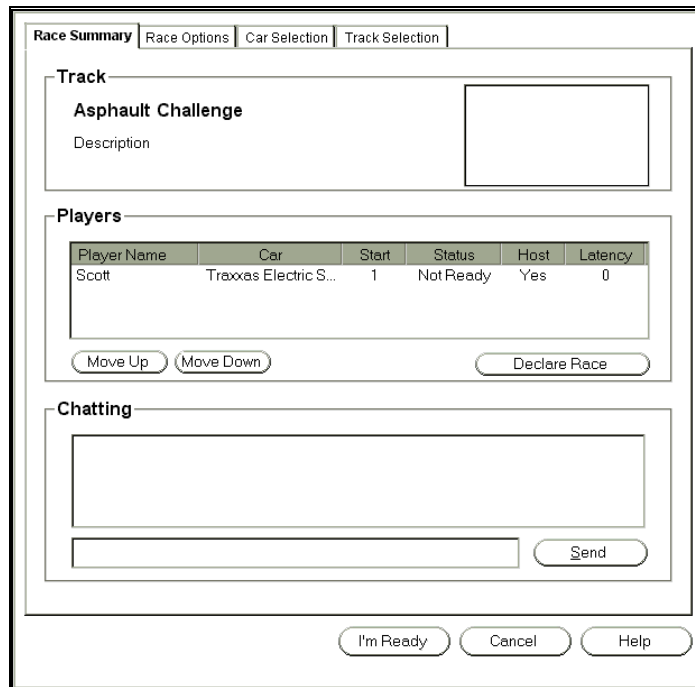


## TCP/IP Address

The session is located by looking at a particular TCP/IP address. It is important that the Host provide this number for you. The address will look something like (183.323.441.100). Don't use the parentheses ☹. If you are playing on a LAN, you maybe able to click enter and have RealRace™ search for a session.

---

## Race Summary



### Track

The name, description and photo of the racetrack selected by the host.

### Players

- Player Name – Each player's name.

- Car – Each player’s selected car.
- Start – The order in which each player will start when racing.
- Status – The current status of each racer. Not Ready, Ready, or Racing.
- Host – Yes, No. Is this player the host?
- Latency – The delay information will take between you and the player. The lower this number is the better. 1000ms = 1 second

### ***Move Up***

Moves a player up in the starting grid. This option is only available to the Host.

### ***Move Down***

Moves a player down in the starting grid. This option is only available to the Host.

### ***Declare Race (Host Only)***

Declares the race to the other players. The Host must pick all the race options and declare the race before the other players are allowed to select their car. The other players will NOT be able to select anything until the host has declared the race.

### ***Chatting***

Displays the chat from the other players. Chatting is the means by which players can communicate.

---

## **Race Options**

### ***Race Time***

This defines the duration of the race. The race will continue until this time has elapsed. The race is completed after each car has finished the current lap they are on. The winner is the player with the most laps completed in the shortest amount of time.

### ***Countdown***

Time to allow for the countdown before each race begins. This is after the warm-up period and before the actual race. If you are on the Internet, allow at least 10 seconds to get everyone to the line.

### ***Allow Pit Stops***

Define whether to allow pit stops. Pit Stops are especially important for longer races.

### ***Pit Notification Time***

Elapsed time before your 'pit crew' tells you that you should pit. This keeps you from having to keep track of your pit time. Once you pit, this clock is reset.

### ***Allow Warm-up***

Choose whether there will be a warm-up period.

### ***Warm-Up Time***

Defines the duration of the warm-up time. This is the time before the race, which allows the racers to get familiar with the course and the other players. Once the race

warm-up period ends, the races will be placed on the starting line, refueled and ready to go.

### ***Allow F4 View (Dynamic Camera)***

Whether to allow the “F4” Dynamic camera views in the race. The host might want to limit the camera views players can use.

### ***Allow F5 View (Driver’s Stand)***

Whether to allow the “F5” Driver's Stand view. The host might want to limit the camera views players can use.

### ***Allow F6 View (Selectable Location)***

Whether to allow the user to position the camera view elsewhere on the track. The host might want to limit the camera views players can use.

### ***Allow F7 Views (In Car)***

Define whether to allow “F7” In-car (behind the wheel) views. The host might want to limit the camera views players can use.

### ***Allow F8 Views (Chase View)***

Whether to allow the “F8” chase view. The host might want to limit the camera views players can use.

### ***Allow Adjustable Camera Height (Arrow Keys)***

Define whether to allow adjustable camera heights. The host might want to limit the camera views players can use.

### ***Connection IP Address***

Displays the IP address of this computer. You need to communicate this address to the other players so they can find your session. The other players will need this before they can join.

### ***Smooth Remote Player Positions***

Define whether to turn on player smoothing. This tries to smooth the animation of the other players. It may not work well on some network configurations. If you notice the other players ‘jumping’ around you may want to turn this off. It will not affect the racing stances.

### ***Allow Late Joiners***

Whether to allow other players after the race has been started.

### ***Simulator Settings***

Adjust the settings such as music, sounds, and screen resolution.

---

# Car Selection



## ***Simple Graphics***

All of the cars have a complex representation and a simple representation. The simple graphics won't look as good as the complex, but it will make the simulation run faster. When you choose this option, all other player's cars will also use simple graphics as well. This selection only affects your computer.

## ***Description***

This box describes the model and any special features it may have. Consult this box to determine the switch layout of the selected car.

## ***Color Scheme***

Change the color scheme to one of 4 different color schemes for each car. There will be no difference in the rendering speed between the different schemes. For a faster rendering speed, use the Simple Graphics option.

## ***Make a Copy of Car***

RealRace™ will not allow you to change any of the default models. It will, however, let you make a copy of a default car and perform modifications to the copy.

### **Delete Car**

Delete the selected car. You can only delete the cars that you have created. Default cars may not be deleted.

### **Rename Car**

Rename the selected model. You can only rename the cars that you have created.

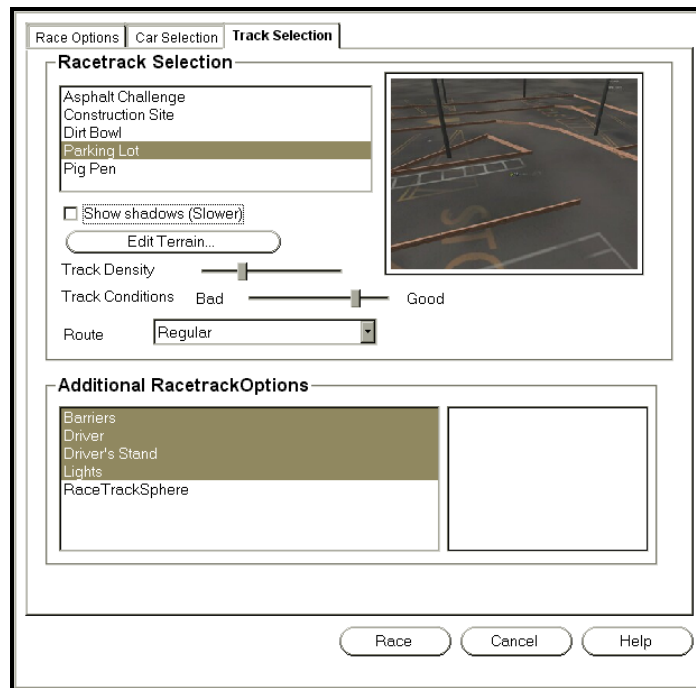
### **Full Edit/Quick Edit**

Edit the selected car. You can only edit the car that you have created. Therefore, it is necessary to make a copy of the model prior to editing.

See “*Quick Edit/Full Edit*” on page 24

---

## **Track Selection**



### **Racetrack Selection**

Select the driving site. Each track offers a different driving experience.

### **Show Shadows**

Sets whether to show shadows that the 3D objects generate. This will look better but slows down the rendering speed slightly. *This affects only the optional racetrack items. The shadow for the car will always be shown.*

### **Edit Terrain**

Choose the Terrain options for this particular racetrack. Bear in mind that these settings, other than track density, will be forced upon the other players.

### **Track Density**

Sets the density of the track. The track density will affect how the car interacts with the track. If you notice that the car seems to 'hover' above the track, then increase this value.

### **Track Conditions**

Defines the conditions of the track. If you are sliding around too much or if you notice the car handling in an 'unpredictable' way, then increase this value.

### **Route**

Sets the route of the race. Each racetrack can have multiple racing routes. The Host will select this.

### **Additional Racetrack Options**

Indicates which items will appear at the driving site. More items will enhance the realism but may slow down the rendering speed.

---

## **Recorded Racing**

The screenshot shows a software interface with a tabbed menu at the top: Race Options, Car Selection, Track Selection, and Recorded Racing. The Recorded Racing tab is active. It contains three main sections: Recorded Races, Recorded Race Details, and Recorded Race Statistics. At the bottom are buttons for Race, Cancel, and Help.

**Recorded Races**  
You can select multiple recordings holding down the ctrl key while clicking on your selections

Racer's Name	Car	Car Co..	Time	Date Raced
Scott	Axis	Regular	-1 / 0:0.0	12-16-1999

Record Your Car's Next Race  
(Recording starts when official race begins) Delete Selected Race

**Recorded Race Details**  
For the best racing experience, you may want to use these settings. These are the settings that were used when the recording was made.

Correlate my race settings with those found in the currently selected recording.

Track Conditions: Bad  Excellent  
Race Duration: 1.00

**Recorded Race Statistics**

Amount of Time: 0m 0.0sec  
Laps Completed: -1

Race Cancel Help

### ***Recorded Races List***

The list of available recorded races for this track. This is essentially a list of all the “.rec” files in the c:\program files\realrace\cars directory. Only races that were raced on the selected track are shown.

You can give a race to a friend by first choosing Delete Selected Race. This will give you the name of the file in the directory. You then cancel the delete and email the file to your friend.

### ***Record your Car's Next Race***

Select this option if you want to record the next race. This will only record the car you are driving. The recording starts when the 'R' (Start Race) key is pressed while driving. It ends when the race is over. Only your last race is recorded.

### ***Delete Selected Race***

Deletes the currently selected recorded race.

### ***Correlate Race***

Take the race settings used for the selected race and apply them to the race you are about to run.

### ***Track Conditions***

The track conditions used for the currently selected race. It is worth noting this setting and correlating to this value, as it can make a big difference in race times.

### ***Race Duration***

The duration of the race when the recording was recorded.

### ***Amount Of Time***

The amount of time the player in the recorded race took to complete the described number of laps.

### ***Laps Completed***

The number of laps that were completed in the currently selected recorded race.

# Troubleshooting

---

## In General

This simulator is on the cutting edge of technology and uses cutting edge hardware to help it. Because of this there is always the possibility you may experience some problems. We have a complete WEB site ([www.realrace.com](http://www.realrace.com)) devoted to solving any problems you might have as well as a troubleshooting section in this manual. To easily access the troubleshooting options, click on the **“Help”** button and then access the “Troubleshooting” page.

If you are having problems installing DirectX, please contact Microsoft at [www.microsoft.com/DirectX](http://www.microsoft.com/DirectX). You can test the DirectX installation by running either or both of two test programs: Fly and Tunnel. These programs appear in the RealRace™ program group. **Note:** to duplicate the RealRace™ simulator’s options select the HAL device under the “File” key. If the menu bar does not appear when these programs are running press the “Alt” button on your keyboard. It is possible that RAMP and RGB will be the only driver emulation. Click on the “Renders” button and turn on the **Z Buffer** and **Clears** in this menu.

If there are any visual difficulties noted in these programs, it is a safe assumption that this is due to a difficulty with the video driver. You should contact the manufacturer of the video card accordingly.

It is extremely important to remember not to scratch or get fingerprints on the CD-ROM. This can cause the program to appear to malfunction when it is really a physical fault.

*Note: Microsoft Windows NT 4.0 currently does not support the current version of DirectX. Therefore, it is incompatible with RealRace™.*

## Solutions to Common Problems:

- Check the CD for scratches on the CD. Even minor scratches or fingerprints can cause random problems.
- Make sure there is at least 30MB available hard drive space. This may be verified by double clicking on the “My Computer” icon and then right clicking on the appropriate hard drive. Next, click on the “Properties” folder. This should reveal the amount of space available on the hard drive. If you need additional space, try emptying the Recycle Bin.

- Ensure that all other programs are closed prior to starting RealRace™. This program works best when it is running by itself.
- If all else fails, try rebooting your computer. Occasionally, Windows 95 and 98 may become unstable after continuous use. A simple reboot may clear up any difficulties.
- Ensure that your computer is running in at least 256 color resolution. This may be verified by right clicking on the desktop and selecting “Properties”. Then, click on the “Settings” and check the color palette box.

---

## Common Solutions

Below you will find solutions to many common difficulties.

### **Solution: Diagnostic Programs**

You can test the DirectX installation by running either or both of two test programs Fly and Tunnel, written by Microsoft, these programs appear in the RealRace™ program group.

If the program starts up in full-screen mode, you may access the menus by clicking the “ALT” key.

#### ***Instructions for Running Fly***

1. In the RealRace™ program group, select the “Fly” icon.
2. From the “Modes” menu, select the resolution which you would like to utilize in RealRace™. If the program starts up in full-screen mode, access the menu by first clicking the “Alt” key. A good starting point is 640 x 480 x 16.
3. Select the “File” menu and ensure that the driver that you wish to use is selected. This should match the one you are trying to use to run RealRace™. If your computer is equipped with a 3D card, select “HAL”. If not, choose the “RAMP” technology.
4. Allow the program to “Run” accordingly, watching the graphics for any visual difficulties.

#### ***Instructions for running TUNNEL***

1. In the RealRace™ program group, select the “Tunnel” icon.
2. From the “Modes” menu, select the resolution which you would like to utilize in RealRace™. If the program starts up in full-screen mode, access the menu by first clicking the “Alt” key. A good starting point is 640x480x16.
3. Select the “File” menu and ensure that the driver that you wish to use is selected. This should match the one you are trying to use to run RealRace™. If your computer is equipped with a 3D card, select “HAL”. If not, choose the “RAMP” technology.

4. In the “Render” menu, turn on “Z Buffer” and “Clears”.
5. Allow the program to “Run” accordingly, watching the graphics for any visual difficulties.

If these diagnostic programs are experiencing difficulties similar to those experienced with RealRace™, then the problem is most likely caused by one of the following:

- If the programs work using RAMP and RGB technology but not HAL technology, the difficulty is most likely caused by your video card.
- If the programs don't function in any mode, DirectX may not be installed correctly or a problem exists with your video card.

### **Solution: Check DirectX Installation**

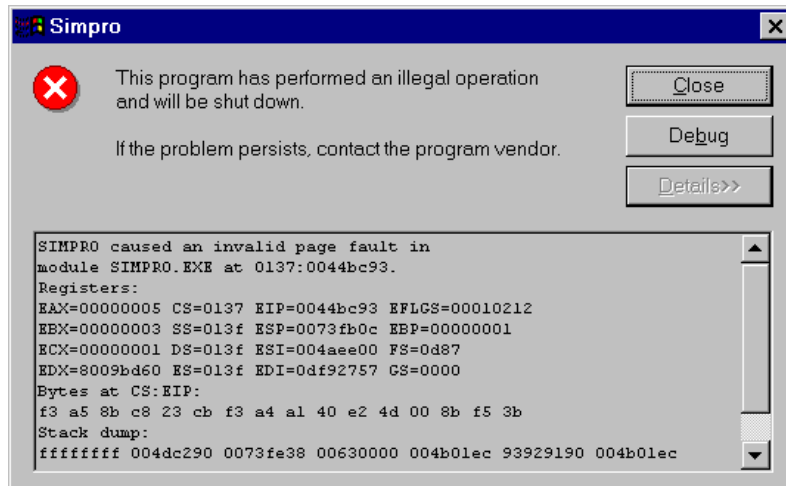
DirectX may not have been installed correctly. Attempt to re-install DirectX once again, ensuring that you click the “Yes” button when the program asks if you want to install DirectX. If you are still encountering problems with the installation of DirectX, please contact Microsoft at [www.microsoft.com/DirectX](http://www.microsoft.com/DirectX).

### **Solution: Check Video Card**

- Make sure your card is installed according to the manufacturer's instructions. This is especially important if you have a 3D pass through card.
- Download and install the latest video driver from the manufacturer to see if this solves the problem.
- If you are still having problems, contact the manufacturer of your video card and report the difficulty. If the problem also occurs when attempting to run the FLY and/or TUNNEL programs (described previously), then be sure to let them know this as well. These are standard programs that ship with DirectX and should function accordingly.
- It is possible that a newer video driver may have more problems than a previous model. After exhausting all of your other options, you might try obtaining an older driver from the manufacturer to eliminate this variable as well.
- Search the WEB. Go to the DejaNews WEB site ([www.deja.com](http://www.deja.com)) and type something like "mystique problem" or "mystique Direct3D" or "mystique DirectX". These searches may turn up other people that are having the same difficulty (Be sure to utilize the name of your actual video card instead of "mystique"). If nothing turns up, try going to the bottom of the DejaNews page and turning on "old" rather than "current" and searching again.
- Visit Microsoft's DirectX WEB ([www.microsoft.com/DirectX](http://www.microsoft.com/DirectX)) site to search their knowledge base and other articles.

### **Solution: Crash Analyzer**

If the program crashes, you will probably see a box like this:



- You can get some hints as to what is going on by looking at the "XXXX caused an invalid page fault in module YYYY at ZZZZ". If "YYYY" is RealRace.EXE, then the problem is most likely in our application. Select (highlight) all the text in the crash dialog and copy the contents by typing Control-C. Using Control-V, paste the results into an email and mail it to us.

There may be other DLL or EXE modules causing the simulator to crash. Below you will find some of the more common occurrences:

- DSOUND.xxx - The problem is probably with your sound card. Please refer to the Sound Card Troubleshooting section.
- If you go through the troubleshooting pages and still cannot fix your problem, then select all the text in the crash dialog and copy the contents with by typing Control-C. Paste (Control-V) the results into an email and mail the bug to us.

## Sound Card Solutions

- Make sure your card is installed according to the manufacturer's instructions.
- Test the sound card to ensure that the sound card works with other Windows programs. If it does not, then the difficulty is probably not related to the RealRace™ software.
- Download the latest audio driver from the manufacturer to see if this solves your problem.
- Some audio difficulties may actually be caused by faulty video drivers. Consult your video card manufacturer to see if there is a newer driver available, or if there are any known problems.
- Search the WEB. Go to DejaNews ([www.dejanews.com](http://www.dejanews.com)) and type something like "Sound Blaster problem" or "Sound Blaster DirectSound". These searches may turn up other people that are experiencing similar difficulties. Substitute the name of your sound card in place of "SoundBlaster" If nothing turns up, try going to the

bottom of the DejaNews page and turning on "old" rather than "current" and searching again.

- Visit Microsoft's DirectX WEB site ([www.microsoft.com/DirectX](http://www.microsoft.com/DirectX)) to search their knowledge base and other articles.

## Clear Cache Directories

RealRace will store frequently used files on your hard disk for quick retrieval. Sometimes these files may become corrupt. If you experience troubles operating RealRace™, try deleting the cache files by going to Simulator Settings/Miscellaneous and clicking **Clear Now!**

---

## Installation Problems

Installation problems are rare, but here are a few you might encounter.

### Problem: Installation Difficulties

If you experience difficulties with the installation of RealRace™, try the following:

- Ensure there is at least 60 MB available hard drive space.
- If the program is already installed, try deleting the folder that the program is installed in. This is usually located at "c:\program files\RealRace". Reinstall the program.
- Click Control-Alt Delete and close all the tasks except for Systray and Explorer. Then try to install the program.

If neither of these suggestions help, see "Technical Support" on page 6.

### Problem: I have Windows NT 4.0 or below

- While not a problem in itself, it is when it comes to running RealRace. RealRace requires DirectX 6.0 which NT 4.0 and below do not support.

### Problem: Program does not launch

- The first time you install the program, it may need to finish the installation. This can take up to 30 seconds on slower computers.
- Try running the diagnostic program. Refer to the Installing and Running Drive and/or Tunnel sections above.
- Click Control-Alt Delete and close all the tasks except for Systray and Explorer. Then try to launch the program. If that works, then you end them one by one to see which one of the programs is the offending program.
- Try clearing the cache directory. Delete the files located at **c:\program files\RealRace\cache**.
- If the program crashes when loading, then see if the crash analyzer has any clues.

- Attempt to run other Windows 95/98 based programs to see if they also crash. If so, the problem may lie with the condition of Windows 95/98 on your system.
- If none of these suggestions help, see “Technical Support” on page 6.

## Problem: Dialog interface

RealRace™ uses a state-of-the-art user interface to allow you to choose your environment and edit your car and racetracks. You shouldn't experience any problems with the dialogs, but if you do...

- Make sure that your Windows desktop is running with at least 256 colors. Refer to the information provided in the **In General** section of this troubleshooting guide.
- 800x600 resolution is the minimum recommended resolution.
- If you receive an error message informing you that you are out of system resource, check to ensure that all other programs are closed.
- If the program crashes when loading, refer to the dialog provided in the crash analyzer for possible clues.
- Clear the cache directory.
- Are you having many crashes with other programs? If so, your problem may lie with the current state of Windows 95 on your system.
- If none of these suggestions help, see “Technical Support” on page 6.

## Problem: Hangs after “Drive Now”

If you click “**Drive Now**” and the “Please Wait” appears and hangs up or does nothing for a long time, here are some possible solutions:

- If you have a slow CD-ROM, and have selected a number of optional racetrack items, it might take a while to load up on slower computers.
- If you have selected the PhotoTrack™ technology with the Direct3D technology, try turning it off. Your card may be unable to support the larger number of textured polygons.
- Reduce the number of scenery elements in an attempt to narrow down the problem.
- Select a lower resolution. Your card may not be able to support the higher resolution. Refer to the “**Picture Resolution**” section above.
- If you are using the Direct3D rendering technology, try changing the driver from RAMP to HAL or HAL to RAMP. If it starts working now, then see “Solution: Check Video Card” on page 81.
- Try turning off some of the options in the Direct3D page. It is possible that your card does not support some of these features.
- Turn off all the sound options in the game play dialog. If it suddenly starts working, it may indicate a problem with your sound card. Refer to the “Sound Card Solutions” section above.

- Try running the diagnostic program to see if it is a problem with DirectX in general. Refer to the “Solution: Diagnostic Programs” section above.
- If the program crashes when loading, refer to the crash analyzer dialog for clues.
- Are you having many crashes with other programs? If so, your problem may lie with the current state of Windows 95/98 on your system.
- If none of these suggestions help, see “Technical Support” on page 6.

---

## Graphics Problems

### Problem: Poor Graphics Quality

I select “**Drive Now**” and the 3D objects are visible on the screen. Problem is, they don’t look very good. Here are some things you can try:

- You may be running at a low resolution. Anything under 640x480 will start to look grainy. Be aware that increasing the resolution will slow down the frame rate.
- Run either of the diagnostic programs to determine if the difficulty is in the card.
- If you are using the HAL driver with the Direct3D technology, try setting it to RGB. If things look better (although probably slower), then your video card or its drivers might be having problems.

### Problem: Slow Frame Rate

I hit “**Drive Now**” and the 3D objects are visible on the screen. Everything looks good, except that the video is “choppy”.

This is a common problem and there are many ways to fix it. Most of the time it boils down to the fact that you don’t have enough CPU or graphics card power to render your settings at a fast frame rate. Here are some things you can do. Note that you should try to do as few of these as possible. Narrow it down to find out which suggestions give you the biggest boost for the smallest drop in quality.

- Use a simpler version of the car (In the Car Selection page).
- Turn down the grid resolution in the Terrain Editor.
- Use lower resolution textures in the Terrain Editor.
- Turn off the background music.
- Turn off VirtualRevolution™ sound technology.
- Turn off the engine sounds (If the frame rate dramatically increases, then you should consider getting an updated sound card driver or updating your sound card).
- Adjust screen resolution to a slightly lower level.

- Turn off Bilinear Filtering, Specular Highlighting and Dithering in the “**Direct3D**” tab under “**Simulator Settings**”.
- Reduce the physics percentage located in the “**Resolution**” tab under **Simulator Settings**”.
- Turn off 24 Bit Textures
- Turn off transparency

---

## Sound Problems

### Sound is inaudible

No sound whatsoever.

- Check the “**Music**” tab under the “**Simulator Settings**” button. Make sure the sound you want to hear is active.
- Make sure the speakers are turned on and plugged in.

### Problem: Sound is “Choppy”

Sound is breaking up, or sounds “choppy.”

- Ensure you are utilizing the latest sound driver release.
- If you are driving the simulator in the Direct3D mode, switch to the Internal 3D technology setting. If this resolves the problem, the problem may be traced to the video card and its Direct3D driver.
- The difficulty may be a direct result of the combination of certain video cards with certain audio cards.

# Comprehensive Guide to R/C Car Set-Up (Bonus Section!)

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## Comprehensive Guide to R/C Car Set-Up

Most of this chapter was written and is copyrighted by Scott Guyatt. Scott has been gracious enough to allow us to include this guide in the RealRace Manual. Most of the concepts that Scott talks about are directly applicable to RealRace™, but some will be more applicable to you when you are out on the track.

Please note that all respective trademarks and brand names belong to their respective companies.

Now with that said, lets move on to Chapter One - Introduction

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## Chapter One - Introduction

This booklet is designed to help you learn about setting up, maintaining and driving radio controlled off-road buggies and trucks. Although primarily directed at off-road racing, much of the discussion here can be related to on-road as well. R/C racing is a complex business - and like any motor sport, it can take an individual many years to learn the intricacies of building and setting up R/C cars.

The most important word in learning about car setup is compromise. Altering one part of your car will always affect another. You will almost always have to make some kind of compromise between two conflicting requirements. The second most important word in learning about car setup is practice. The only real way to learn is to alter your car, drive it, alter it again, drive it again etc.

This publication is not designed to take the place of practice, or experimentation - nor should it be considered to be infallible. What we hope to achieve, however, is to give you some ideas to contribute towards your learning about car setup.

I have been racing off-road buggies for over 10 years and in that time have achieved much both on and off the track within the sport in Australia. I make no claim to know everything there is to know about R/C racing, but have collected some knowledge of car preparation and setup during that period. It is this knowledge that I hope to pass on to you.

During my R/C career, I have raced in all classes, with cars from such diverse manufacturers as Tamiya, Kyosho, Marui, Mugen, Schumacher, Team Losi, Yokomo, Team Associated, Traxxas etc. I have used electrical gear (including motors, batteries, speed controllers and radios) from just about every major manufacturer. I trust that I will be able to translate some of the information I have been lucky enough to glean through this wide experience into useable data for you.

I take this opportunity to wish you all the very best in your R/C racing. Remember above all that we're here for fun. Race hard, but race clean and walk off the driver's stand with a smile on your face.

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## Chapter Two - Glossary of Terms

### ***Anti-Roll Bar***

An anti-roll bar is a wire device fitted to the car which limits, or prevents the car 'body rolling' from side to side through corners.

### ***Anti-Squat***

See also (Caster). Anti-squat is generally used on the rear suspension of the car and refers to the angle of the rear suspension arm hinge pins in relation to the chassis.

### ***Camber***

Camber refers to the angle of a wheel in relation to the vertical (perpendicular). 'Negative' camber means that the top of the wheel leans in towards the center of the car, whilst 'Positive' camber refers to the situation when the top of the wheel leans out - away from the center of the car.

### ***Caster***

A hard one to explain! Caster refers to the angle of the front king pin in relation to the vertical. The king pin may be either a solid pin, or imaginary line through the center of the steering block. Castor is measured in degrees and generally refers to the angle which the king pin leans back from the front of the car. A typical castor angle for a two-wheel drive buggy or truck is 25 degrees. A four-wheel drive buggy may vary from 5 to 20 degrees.

### ***Drop***

To put in simply, drop refers to the amount your suspension arms hang down.

### ***Pistons***

A piston is a crucial part of the internal mechanism of a shock absorber. The piston is mounted on the end of the 'shock shaft' and is typically a thin plastic disc with a number of holes drilled in it. Changing the piston for one with either larger, or smaller holes or a different number of holes can have a dramatic effect on the performance of the shock absorber.

## ***Ride Height***

Ride Height refers to the distance between the ground and the bottom of your car's chassis when it is at rest. To check ride height - work your car's suspension up and down a few times, then drop it onto a flat surface from a height of about 12 inches. Some manufacturers will give you a reference point for checking ride height - e.g. Rear suspension arms level, or Drive shafts level. This can help you easily compare your ride height settings time after time.

## ***Shocks***

The shocks, shock absorbers, or dampers are silicon oil filled 'cylinders' used to slow the motion of the springs supporting the car's suspension. Shock absorbers can generally be adjusted by either altering the internal configuration (see Piston) or by using oil of differing viscosity (or 'thickness').

## ***Sway Bar***

See (Anti-Roll Bar)

## ***Toe***

Toe is the angle of the wheels in relation to the centerline of the chassis. Toe-in refers to the setting when the wheels point 'inward' whilst Toe-out refers to the setting when the wheels point 'outward'. You can check 'Toe' by placing a ruler against each wheel - if the ruler points inward - that's Toe-In.

## ***Wheelbase***

Wheelbase is the distance between the front and rear axles of your car.

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# **Chapter Three - How do I go about it?**

As we've already discussed, learning to tune your car is about practice. There are, however, some basic ground rules, which we can lay down to help you when you go to practice, or tune your car. Take note of these:

## **Basic Setup**

Try to develop for yourself a stock, or basic setup. These are the settings you should use every time you go to a new track, or anytime the conditions at your track are much different from normal (e.g. new dirt, new track layout etc). In most cases, your standard setup should be the kit settings. Manufacturers spend a lot of time establishing a good basic setup - trust them. If, however, you find some small changes that really suit your driving style, adopt them into your basic setup.

## **Be an Individual**

It's good to share setup information with others - particularly if they're using the same equipment as you. It's important to recognize however, that each individual drives a little differently, and prefers a different balance to their car. Once you've reached a ballpark setup (usually tires, shocks and springs) do the fine-tuning on

your own. Don't worry if you're not using exactly the same settings as the guy next to you - you're just as likely to be right as he/she is!

## **Write it down**

Get a notebook to take with you to the track. When you change your car make a note of what you changed, what affect the change had, and the track conditions at the time of the change. Pretty soon you'll build up a good database of information about what tuning adjustments do to your car's handling.

Ideally, many manufacturers now produce blank setup sheets for their cars. These setup sheets let you mark all your settings in a simple, easy to understand manner. I'd suggest you grab a blank sheet, do some photocopies and keep them in a folder in your track box. Then after each race day you can make a note of what settings you ended up using and what the track conditions were like. Again - you'll soon build up a database of setups for different tracks and track conditions.

## **Don't be afraid to Ask**

Never fear asking for help. If you've got some difficulty adapting your car to strange conditions, you're just not sure how to change it to get more steering (or less!) - ask. Most racers are happy to help those less experienced than them - until you start beating them! Look around for someone whose car is running hot - and ask him/her for advice.

## **Change one thing at a Time**

One of the most important rules of car set-up is to make changes one at a time. If you change tires, and suspension settings - how will you know which cured your steering problem? If you raise ride height and add a stiffer spring - how will you know which cured your jumping problem? My advice is to always make one change at a time - then try the car. If it doesn't work - change back, and try something else. This is the most effective way to track down the correct settings - and at the same time to learn about setting up your car.

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# **Chapter Four - Choosing the Right Tire**

The choice of tires is probably the single most crucial factor in getting your car to handle well. If you choose the wrong tires, there is often very little you can do to retrieve the situation. We'll cover a number of variables at work in determining the correct tire choice - hopefully helping you to 'guess' correctly the first time you run on a new track or surface.

Let's initially concentrate on rear tire choice - front tires will be considered separately towards the end of this chapter. I won't treat truck tires differently - most of the tires listed here have an equivalent in the truck tire range. You just need to check with your retailer as to the approximate truck equivalent.

## **Compound**

The 'compound' or 'softness' of the tire can often have a major impact on it's performance. Each different tire manufacturer has their own range of tire rubber - giving different names to each different compound.

The first thing to realize about tire compound is that softer is not necessarily better. The new generation 'super soft' compounds work only in certain situations. Super soft tires should be used when the track reaches 'blue groove' conditions. This is when there is practically no dust on the racing surface - just a rock hard, concrete like surface where the racing line comes up 'blue' from deposited rubber. In these conditions tire traction is mostly generated by the rubber compound in use and it is then that super soft tires should be used.

In general, the soft compound tires will perform best. Well packed track surfaces with some loose material on the surface are particularly well suited to these types of tires. Dusty conditions also suit soft tires.

Medium compound tires can be most effectively used when the track condition is bad. When predominantly loose material is on the surface, when the track starts to break up into 'rubble' or in moderately wet conditions, medium compound tires should be your first choice.

Hard tires are rarely used. Only if the track is particularly wet/muddy, or if the track surface is grass, or some similar multi-surface, should hard compound tires be used.

## Tire Profile

The profile or 'carcass shape' of the tire is another crucial element in choosing the right tire for your car and track conditions. Tire profile can be roughly categorized into two alternatives - 'square' or 'rounded'. There are other profiles, and some tires which fit in between the two extremes, but let's not get too carried away.

A square tire is one which has a flat 'crown'. That is, a tire which will stand on it's own on your pit table and where most of the tire surface sits in contact with the table surface. Square profile tires almost always provide excellent forward traction (due to large contact patch).

In smooth track conditions, square tires can also provide excellent 'through corner' traction. These tires suffer most when tracks start to break up, or in conditions where the car is constantly sliding sideways. In these types of condition square tires can slide unpredictably, or can 'catch and edge' in ruts and holes - causing the car to flip, or get out of shape.

A 'rounded' tire is extremely predicable through corners, and excellent in rough, rutted conditions. Whilst not so good at generating forward traction in smooth conditions, the rounded tire is almost universally chosen when the going gets rough

There are also a number of tires that can be considered to be 'in between'. It's not really rounded, yet not completely square and is often a good compromise tire.

## Tread Pattern

Of course, the most obvious difference between one tire and the next is the tread pattern. We'll not get into arguments about which company makes the best tread pattern, but will simply categorize the most commonly available tires, and give some description of the conditions in which they're put to best use.

## Buggy/Truck Rear Tires

Buggy and Truck rear tires are mostly fairly similar in appearance (and often name

### ***Microspike***

These tires are used when track conditions reach, or approach 'blue groove' status (see above). When the track is almost dust free, and fairly smooth, reach for a set of these tires.

### ***Fuzzy***

These tires are most suited to hard packed, but slightly dusty track surfaces. Also work well in blue groove conditions, and can be OK in looser conditions. One of these tires should definitely be in your pit box.

### ***Minispike***

Perhaps the best compromise tire of all, these will work in almost all conditions. This tire choice is most risky in blue groove conditions when low contact patch can count against them.

### ***Stud/Stubby***

These tires are at their ultimate in loose, broken conditions. When the previously smooth track starts to deteriorate, grab a set of studs out of your box. Surprisingly perhaps, these tires have also been known to perform exceptionally well in well packed track conditions. Again, a tire of this type is well worth having in the pit box.

### ***Step Pin***

These tires are perhaps the ultimate compromise tire. Whilst at their best in looser conditions, step pins also work well in broken, messy track surfaces and the mini-step in particular works well in anything up to blue groove conditions. One of these should probably be in your arsenal.

## **2wd/Truck Front Tires**

Most 2wd or truck front tires are of the 'ribbed' variety. That is, they feature a series of vertical ribs running the length of the tire. The differences are in the width of tire, shape, height and width of ribs, or external reinforcing braces. 2wd front tires are particularly an individual preference. You should keep a couple of different pairs of front tires in your box, but don't be too concerned about what other people are using - run the front tires which give the level of front grip you feel comfortable with. As a general rule of thumb, run the hardest compound tire you can which provides the necessary traction. There are many setup options in your car which can assist in providing steering - exercise these before moving to softer tires.

### ***Standard Ribs***

These tires feature 4 square, upright rubber ribs with no external reinforcing or bracing. Standard rib tires are the most commonly used front tire. The tire shape will work in almost all conditions, with compound choice being the critical factor. In looser conditions, opt for the medium or hard compound front tires. These will help the tire ribs 'stand up' under cornering pressure and produce more consistent front grip. In dusty, or harder track surface conditions, a slightly softer compound may be necessary to generate necessary traction.

### **Supported ribs**

These tires use either 'shaped' ribs or external bracing to help the tire ribs 'stand up' under extreme pressure. In general, these tires can be used in a softer compound and are at their best in hard packed, or blue groove conditions.

### **4wd Front Tires**

4wd front tires are a much easier choice than rear tires. There are only a limited number of options, and choice of front tire very much depends on rear tire choice. There are a number of 'rules' however, which should be followed.

Always run a front tire with the same overall 'diameter' as the rear tire. If you feel the need, you can manufacture 4wd front tires by cutting up a set of rear tires, removing a strip from the center of the tire, and re-gluing the 'outer halves' using good quality superglue. I do not recommend this course of action. 'Manufactured' front tires are difficult to do, prone to disintegration, and not particularly beneficial in any case. In 7 years of 4wd modified racing, I have never encountered the need to manufacture front tires.

### **Foam Inserts**

Most rear tires (with exception of 'hard' compound tires) will require the use of a foam insert. In most cases, these will be provided with the tires. Foam inserts can generally be used as supplied, with just a minor modification. Cutting the square edge of the outside of a foam insert can produce a slightly 'softer' tire sidewall and slightly more 'rounded' profile when using square tires. This can help to make the tires more consistent through corners, and less likely to 'grab' and roll in rutted conditions.

Softer tires also require more 'dense' foam inserts. If you are planning on using the 'super soft' compound tires, you should try to make sure that you have a set of 'dense' foams at your disposal.

Front tires too, will often require foam inserts. In particular soft, and super soft compound tires should always use inserts. You can, however, sometimes get away without inserts in a medium compound tire. Running no insert will result in a slightly 'softer' tire that behaves almost like a tire compound in between medium and soft. Sometimes worth a try if you can't quite settle on the right front tire compound.

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## **Chapter Five - Shocks and Springs**

Shock absorbers and springs are universally the most misunderstood, yet critical part of any car suspension - particularly an off-road R/C buggy. When your car can be jumping up to three feet into the air and flying anything up to 10 feet before landing, it's important that your shock absorbers and springs can control the car on landing. The difficulty is that those same shocks and springs have to help the car get around corners, and manage over innumerable smaller bumps, ruts, holes and lumps of rock and dirt. Sounds like quite a feat!

Perhaps more than any other part of the car setup, choosing the right combination of shock absorber and spring setup is a compromise. You need to weigh very carefully

the need to get the car through the corners - for which low ride height, stiff springs and 'hard' dampers can help - with the need to help the car soak up bumps and jumps (high ride height, softer springs and lighter damping!). Let's start by taking a look at the shock absorbers and how they work - what each adjustment does.

## Shock Absorbers

It is the shock absorbers' job to control the car's suspension. While the springs keep the car off the ground, the shocks must control, or slow down, the spring's action. Just how much to slow down that action is the great dilemma in setting up shock absorbers.

A shock absorber typically contains a number of parts: the shock body keeps it all together and contains the shock oil; the shock shaft protrudes from the shock body and connects the piston at one end, and the suspension arm at the other. Shock seals keep all the oil on the inside (where it belongs), while the volume compensator makes allowance for the oil that is displaced when the shock shaft and piston enter the shock body. The 'damping' effect of a shock absorber comes from the resistance of the piston to moving through the oil-filled shock body.

The variable parts of a shock absorber are the length of the overall unit, length of shock shaft, travel limiters on shock shaft (both inside and outside the shock body), the piston attached to the shock shaft, and finally the viscosity (thickness) of the silicone shock oil used to fill the shock body. Let's take a look at each of these adjustments and the likely effect on your car.

## Shock Oil

Shock Oil is the simplest, most universally used adjustment to the shock absorber. Using thicker shock oil will help to 'slow down' the suspension motion of the car while lighter oil will do the opposite - letting the suspension react more quickly to the demands of the track. Thicker oil is most often used when track conditions are smooth, and hard packed and traction is high. In these conditions suspension movement detracts from the handling of the car.

Thicker oil is also useful for controlling the car when landing off big jumps. When the going gets rough - if there are numerous ruts and holes or a lot of small jumps, or if the track is particularly slippery - lighter shock oil should be used. This will let the car react more quickly to the track - helping to keep the tires in contact with the track.

Shock oil viscosity (or thickness) is measured in 'weights'. The higher the number, the thicker the oil. While most companies' shock oil is reasonably close to each other's, there are some slight variations. Why? I have no idea! The solution is to try and always use oil of the same brand. It doesn't particularly matter which brand of oil you use, but you should try to always use the same brand.

## Shock Pistons

Shock Pistons are a bit of a black art as far as many racers are concerned. Variables in shock pistons include the size, and number of holes in the piston. Pistons with larger holes allow the shock oil to travel through more quickly, while smaller holes will slow the travel of oil through the piston. The difficulty is in knowing how to using this adjustment. In most conditions, your car's standard piston configuration will be fine. When the track is particularly rough, with lots of small to medium bumps and holes, pistons with larger, or more, holes will be helpful. When the track

is smooth, or if it has big jumps or drop-offs, smaller holed pistons could be the way to go.

What is important to remember is that pistons and shock oil have a very close relationship. Sometimes if you change one, you need to change to other. An example of this would be that when fitting larger holed pistons to your car you should probably use slightly thicker shock oil. Most manufacturers offer a range of pistons for their shock absorbers and there are a number of aftermarket alternatives.

Alternatively, some drivers have taken to drilling different sized holes in their shock pistons. This is particularly common amongst team drivers to make very small adjustments. Such fine adjustment is not really necessary for the majority of us and should be left as a last resort. Similarly, the use of 'dual stage' pistons which have a different action on the up stroke when compared to the down stroke is probably not advisable for drivers early in their R/C career. If you wish to try some of these options - then it is probably best to consult the local 'pro' driver. They'll be happy to help you figure out what to try.

## Travel Limiters

Travel Limiters are small spacers placed over the shock shafts to limit the travel of the shock absorber. Limiters placed outside the shock body limit the 'up travel' of the shock absorber, while placing spacers inside the shock body limit the down travel (and hence overall length) of the shock absorber. This is not an adjustment commonly used - once set it's usually forgotten.

Adding travel limiters to the inside of the shock absorber can be particularly useful on a very smooth track, while a track with big jumps will probably see some drivers adding limiters to the outside of the shock absorber - to prevent 'bottoming out' of the chassis on landing. Again, this is an adjustment not commonly used in the early stages of your racing. Set the shock limiters according to the manufacturers' suggestions and you'll be fairly close.

## Shock Shafts

Shock shafts can sometimes be changed to longer, or shorter units if more, or less overall travel is required. This type of adjustment is used only very rarely or in extreme circumstances on a very small range of cars. Again, the best advice is to consult your local 'pro' driver and see whether they are using longer, or shorter shock shafts.

## Springs

Springs are a very useful adjustment for the suspension of your car. Springs vary in length, and 'stiffness'. A 'stiffer' spring is harder to compress between your fingers than a 'softer' spring. Stiffer springs will tend to hold the car up off the ground more, while softer springs can allow the car to ride lower, and to 'roll' from side to side more.

### ***Springs, Jumps and Bumps***

Springs are often changed to reflect the size and shape of bumps and jumps on a track. If your track is relatively smooth with lots of big jumps, you should try a slightly stiffer spring - to help the car land off jumps without bottoming out. On the other hand, if the track has lots of bumps and ruts, but no real large jumps - you can

try a softer spring - to let the suspension soak up the little bumps without effecting the chassis balance too much.

## ***Springs and Handling***

Oddly enough, the springs you choose can have a large impact on handling of your car. Changing to stiffer springs will generally result in lower traction at that end of the car - e.g. putting a stiffer spring on the front of your car will often give you slightly less steering while adding a softer spring to the rear can give more rear grip - to a point. Amazingly, in some conditions, the opposite can be true - stiffer springs can add traction.

If you are racing on a high traction track, sometimes adding a stiffer spring can give you more traction by helping the suspension to keep more pressure on the tires. Remember this one if you're on a high traction track. Most importantly remember that when you're choosing springs - there's a compromise between handling and ability to cope with bumps and jumps. You've got to experiment a little to find the right combination for each track!

## ***Spring Clips and Spacers***

Many people adjust the 'compression' or 'pre-load' of their springs by either adding spring clips to the shock body, or moving the 'spring collar' up or down the shock body. This adjustment is only for adjusting the ride height of your car. Adjusting the spring compression does not 'stiffen' or 'soften' your springs. For more discussion of ride height and its effect on handling - see Chapter 4 (Suspension Geometry).

It's good to have a range of springs to choose from. Most manufacturers color code their springs to help you identify stiffer and softer springs.

## **Shock Mount Positions**

R/C cars offer differing standards of tuning options from manufacturer to manufacturer. Almost without exception they all offer alternate mounting options for shock absorbers. Mostly, the options relate to the distance along the suspension arm that the shock mounts, or the angle of the shock (by altering the top shock mount position). These two options provide various responses in terms of the handling of your car. Let's take a look:

Moving the bottom of the shock along the suspension arm basically affects the 'stiffness' and 'drop' of the suspension. Moving the shock mount further out results in a suspension that appears both 'stiffer' (sprung) and 'harder' (damped). Conversely moving the shock inward gives a softer feel. The reason for this is simple. The easiest way to explain this is to think back to the playground seesaw of your childhood. Remember that even if the people on either end don't weigh the same - simply by moving the heavier person closer to the center - the seesaw can be made to balance. It's simply a question of leverage. As the shock moves out along the arm, it can bring greater leverage to bear on the suspension arm. Moving the bottom of the shock along the arm also affects the suspension drop - further out equals less drop, further in equals more drop. Suspension drop is covered in depth in Section (6) of this book.

Moving the top of the shock absorber has a more subtle effect on the car's suspension. What is changing here is the angle of action of the shock absorber. Changing the angle makes the shock absorber more, or less, progressive. A progressive suspension setup describes the situation where the suspension becomes

stiffer as the shock/spring/suspension is compressed. Leaning the shock absorber over further results in a more progressive suspension. This is useful in landing off big jumps (helps stop the car from bottoming out), handling on smooth tracks, handling in high-speed corners. Standing the shocks straighter helps in rough conditions, or tracks with lots of quick changes of direction. Adding interest to this setup option is the fact that leaning the shocks in gives some degree of anti-roll effect while standing them straight up encourages, or allows, more chassis roll. The shock angle you choose can thus be closely related to the use of an anti-roll bar (see Chapter 6).

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## Chapter Six - Suspension Geometry

Trying to explain suspension geometry is not an easy thing. We'll try to give you an overall picture of what 'geometry' is and does - and give you some general hints on what changes affect the handling of your car. More than any other section of this book, the motto for this chapter must be: change your car, practice, change your car, practice, change your car, practice..... You sometimes just have to make a change to the car and try it - and do your best to pick out the difference.

Suspension geometry refers to a lot of things. Basically, it is the various angles and mounting points of wheels, axles, suspension arms and uprights. Shock absorber mounting positions can also be considered to be suspension geometry but we've already covered them in Section (4) so we won't do it again. Words most commonly heard when talking about suspension geometry are camber, caster, ride height and toe-in. If you don't understand what's meant by these terms - look them up in the Glossary (Section 2) before you go any further.

### **Camber**

Camber is probably the easiest component of suspension geometry to adjust - if your car is fitted with turnbuckles or some kind of threaded rod for an upper suspension link. Here are some general rules of thumb.

#### ***Front Camber***

On the front of your car or truck - adding negative camber will, in general, slightly increase steering up to a certain point - and then decrease it after that. That point is around 3-4 degrees. I would suggest that you start with about 2 degrees of negative camber (whatever the car) and NEVER adjust it more than 1 degree either way. Running more negative camber will simply take away too much steering and add unpredictability to your car's handling, while running positive camber of any kind is generally not a great idea. Positive camber can induce unstable handling - and a particular loss of traction for the outside tire in any corner (and the outside tire is the one that does about 80% of the work).

#### ***Rear Camber***

On the rear things get a little more complicated. We need to consider both driving traction and cornering traction. Driving traction is what gets us going in a straight line - the more you have, the faster you can accelerate. Cornering traction is what helps the car to track around corners - without the back of the car spinning out. In general, the most driving traction comes with the tires at 0 degrees camber - neither

positive or negative. This is because the tire is flat to the track with the most possible amount of rubber touching for more grip.

Unfortunately, cornering traction can be enhanced by adding a little negative camber - just like the front of the car. Interestingly enough, most cars will run fairly consistently with around 2 degrees of negative camber on the rear. Again - as per the front, I would suggest that you adjust this by only 1 degree either way. Again, NEVER run positive camber - it will lead to unpredictable driving traction - and probably a lot of spinouts in corners.

## Camber Link Mounting Positions

Many modern R/C racecars have some options for mounting the camber links in different positions. Manufacturers spend a lot of time testing the cars and the kit settings will be the most consistent for the vast majority of racing conditions. There are no valid generalizations that I can give you to help decide when and how to change the mounting location of your camber links. Suffice to say, that I believe firmly that you should trust the manufacturers judgment in this matter. If you feel the need to try some other options - then try the holes immediately adjacent to the standard position. Really, it is a case of trial and error.

## Caster and Anti-Squat

Caster and Anti-Squat are basically the same thing - except that caster refers to the angle of the suspension 'upright' (and is generally used in reference to front suspension) while anti-squat refers to the angle from horizontal of the whole suspension arm mounting pin (and is generally used in reference to rear suspension). Let's take a look.

Caster adjustment on the front of most buggies is by using different front uprights. In most cases, 2wd cars run between 20 and 30 degrees of caster, while 4wd cars run a bit less - typically 10 to 15 degrees. This is another instance where your manufacturer has done a lot of work to find the best answer - in general you should trust them. However, there are some generalizations that can be made. Adding caster (leaning the uprights further back) will generally give less initial turn-in, but more on-power steering and better straight line stability, while decreasing caster will generally add some turn-in, but at the expense of on-power steering and straight line stability.

The other possibility is that your car may be fitted with a 'variable caster' or 'active caster' setup. This means that as the suspension compresses, or extends, the caster automatically changes. While common in on-road cars, variable (or 'active') caster is less common on the dirt.

Anti-squat adjustments are available on the rear of most modern buggies and trucks. Anti-squat is typically adjusted by either replacing the rear suspension arm mounts, or placing washers or wedges under one end or the other of the mount before tightening the mounting screws. This results in a change in the angling the suspension arm - lifting the front edge of the arm higher than the rear edge. Anti-squat does exactly what you might guess by its name - it prevents the rear end of the car from squatting under power as the car accelerates and weight transfers rearwards. Anti-squat does also have some other effects (as with any adjustment - there is always a trade off). Let's take a look at the effect of altering anti-squat on both acceleration and cornering.

## ***Adding Anti-Squat***

If you add anti-squat, your car will (in general) get more 'driving traction' and hence accelerate faster. When you come out of corners, you will be able to use more throttle and your car will be more stable. But (and it's a BIG but), when you back off to turn into a corner, your car will have less rear grip. This might result in your car spinning out when you back off the throttle. Adding anti-squat also affects the way your car drives through bumps on the track. If the track is bumpy right where you want to accelerate, anti-squat is not a good thing - it will make the rear of your car very 'bouncy'. On the other hand, if the rough stuff is in a place where you are cruising on constant throttle, or even decelerating, then anti-squat will actually help your car to 'cruise' through the bumps more smoothly.

## ***Decreasing Anti-Squat***

When you decrease anti-squat you lose rear 'driving' traction. Your car will be a little more prone to power slides and fishtails. However, you will have more traction on a trailing throttle - resulting in your car being more stable into corners. It will also accelerate better through bumpy parts of the track.

## **Toe**

The adjustment of toe is one of the most useful fine-tuning aids in making your car handle just how you like it. On the front of your car, lengthening or shortening the steering rods adjusts toe; while on the rear it is usually adjusted by changing the suspension arm mounts, or using different hub carriers or suspension uprights.

Essentially, toe adjustment works like this: Adding toe-in (front of wheels point inward) adds straight-line stability, while adding toe-out (front of wheels point outward) tends to make the car wander a little. Like all suspension geometry adjustments - this is only true up to a certain point - beyond which the results are generally unpredictable. Let's look at that in a little more detail.

### ***Front adjustment***

Changing toe on the front wheels is probably the best way to get that last little fine tuning adjustment right. Adding a little toe-in will reduce turn in slightly, and produce a car that tracks well in a straight line. On the other hand, reducing toe-in, or adding a little (very little) toe-out can provide a slight increase in steering. As with all suspension adjustments - go a little at a time. Front toe adjustment should never exceed 3 degrees negative, or 1-degree positive.

### ***Rear adjustment***

Due to the nature of rear toe-in (adjusted by replacing suspension mounts or hub carriers/uprights), adjustment of rear toe-in is quite uncommon. Just as with the front adjustment, more toe-in will add traction and stability, while less will promote sliding and instability. Rear toe-in should probably never exceed 4 degrees negative or be less than 2 degrees negative. Most modern cars are supplied at 3 degrees negative and will never need to be changed.

The other interesting part of rear toe adjustment is that some cars use different suspension arm mounts to achieve the adjustment, while others use different suspension uprights to make the change. The first case (suspension arm mounts) is called 'inboard toe-in' because adjustment is made at the inboard end of the

suspension arm and affects the whole arm. Altering the upright is called 'outboard toe-in' because (you guessed it) it's making an adjustment at the outboard end of the arm. Inboard toe-in can produce slightly different handling characteristics to outboard toe-in in rough track conditions.

## **Ride Height**

Ride height describes the distance between the track surface and the underside of your car's chassis. Sounds simple. The simple truth is, ride height adjustment can sometimes be easy to get wrong - and can have a devastating effect on your car.

Fortunately, there are some relatively simple rules that you can follow to help make sure you get the ride height correct - most of the time.

First, let's accept this basic fact: Ride height is controlled by the amount of pre-load applied to your springs through the use of spring spacers, or the movement of an adjustable spring collar. Adding spring spacers does not stiffen the spring - it just lifts the car higher off the ground. You can also adjust ride height by using travel limiters inside the shock absorber or by selecting different shock mounting positions on some cars. Basically though - spring pre-load is it.

### ***Simple Rule 1***

Always run the car with the chassis level. That is - the ride height at the front must equal the ride height at the rear. While there may be some very odd circumstances where you'll want to run the front higher than the rear (or some even more odd circumstances where you'll want to run the front lower than the rear), it is true for most conditions that the car will be most consistent if the front and rear ride heights are equal.

### ***Simple Rule 2***

The rougher the track, the higher the ride height must be. As the race day progresses, if the track starts to break up - one very simple method of adjusting your car to cope with the changing conditions is to slightly (and I emphasize the word slightly) raise ride height. Make adjustments on the spring collars of about 2 mm per time.

### ***Simple Rule 3***

The higher the traction, the lower the ride height. If traction is very high (wet track, or good grippy clay, or 'blue groove' conditions) your car will handle best (and resist traction rolling) with a lower ride height. If the track is very grippy, and very rough - then you've got a typical suspension tuning situation - you need to compromise.

### ***Simple Rule 4***

Remember that changing tires can drastically change ride height. Always be aware that when you change your tires - you might have to re-adjust your ride height.

## **Anti-Roll Bars**

Anti-roll bars (or 'sway bars' as they are sometimes known) do one thing. Prevent, or inhibit a car's natural tendency to have chassis 'roll' or 'lean' towards the outside of a turn. A lot of the car weight wants to keep going straight ahead - thus throwing

more weight onto the right side (or outside) suspension and cause the whole car to 'lean' over.

The anti-roll bar prevents this lean by transferring some of the 'leaning force' across to the other side of the car. Anti-roll bars (as the name suggests) help your car to sit 'flatter' through corners. Anti-roll bars are most useful in high grip, smooth track conditions - and probably in high-speed corners too.

In lower grip, or rougher conditions, anti-roll bars can take away grip from the end of the car you use them on, or simply prevent the suspension from working as freely as it possibly can.

Variables with anti-roll bars include the thickness of the bar, the location of the anti-roll bar mount on the suspension arm, and the location of the mounting joint on the anti-roll bar. Basically it's like this - to 'stiffen' the bar (or increase it's effectiveness) use a thicker anti-roll bar, mount the anti-roll bar further out on the suspension arms, or mount the connecting joint further 'up' the bar (closer to the bend). To 'soften' the anti-roll bar - do the opposite: use a thinner bar, mount closer to the center of the car, or further out along the bar itself.

Note that for testing purposes, if you've got an anti-roll bar fitted to your car and you want to disconnect it, you can simply disconnect one end of the bar. That will remove the 'anti-roll' effect and leave you free to try without it. In racing situations, it's always safer to completely remove the anti-roll bar from the car if you don't want to use it.

On a 4wd it is a very good idea to have an anti-roll bar available for the rear of your car. In my experience, 4wd cars use an anti-roll bar at least 50% of the time. 4wd electric cars are different from 2wd in that the saddle pack battery setup means that more weight is distributed further out along the chassis - thus increasing chassis roll.

On a 2wd you are not going to use an anti-roll bar anywhere near as often. You should be able to race very happily without any form of anti-roll bar on your 2wd (although having said that - a soft anti-roll bar is a very good tuning tool to have - particularly on fast, smooth, high grip tracks.

I have personally never seen an anti-roll bar used on a Truck. Not sure why - perhaps trucks tend to sit flatter due to different shock mounting positions. If you're a truck racer there's certainly no need to rush out a pick up an anti-roll bar.

Other ways to get anti-roll: you can also get some kind of anti-roll effect from using different shock mount positions. This topic is covered in Section (5). Remember though, if you change the shock mount positions to get better anti-roll effect - you'll probably upset some other part of the suspension setup.

## Suspension Drop

Suspension drop is adjusted by the use of shock travel limiters inside the shock, or by mounting the shocks in different positions on the tower or arm. Simply put, more drop is useful on a rough track, or sometimes in case of a slippery surface. More drop can also help your car to land better after big jumps. Less drop results in sharper handling and is best used on a smooth, high-speed track. Less drop will help your car to change direction more quickly.

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## Chapter Seven - Wheelbase & Weight Distribution

Wheelbase and weight distribution are inextricably linked. They are also very useful fine tuning tools. Many modern cars include the ability to alter both wheelbase and weight distribution within the framework of the standard car. Additionally, there are many manufacturers offering longer, or shorter chassis options for their cars.

### Weight Distribution

When you're building your car, you should always do your best to have weight evenly balanced across the car (from side to side). A car that is not balanced from side to side will struggle to jump, accelerate or handle consistently. Side to side weight balance is not a tuning option. You should get it evenly balanced and forget it.

Altering weight balance from front to rear is both more easily achieved, and more useful as a tuning tool. Basically it works like this:

#### *More Weight to Front*

More weight toward the front of the car equals more steering, and less rear grip. Moving the weight up front will also tend to encourage your car to jump more nose down, and stop the car from 'wheel standing' in extreme traction conditions. The easiest way to achieve a change in weight balance is by moving batteries forward in the chassis. Alternately, you can relocate electrical components further forwards but this is both difficult and time consuming. Battery placement is the way to go.

#### *More Weight to Rear*

Moving weight toward the rear of the car does fundamentally the opposite. Adds rear traction, takes away steering, makes the car more stable under both acceleration and braking and can encourage some degree of wheel standing in extreme traction or rough conditions. Rearward weight balance can also help the car to jump a little flatter if it is jumping 'nose down'. Altering weight balance to the rear is achieved in the same way - by moving batteries backwards within the car.

As an alternative - you might want to add more weight to front or rear without taking weight away from the other end (this is what happens when you move the batteries around). In this situation, seriously consider adding some small lead weights (mag wheel balance weights) or coins. Add this weight at the extreme end of the chassis, and as low as possible. Many 2wd cars and trucks have a perfectly shaped hollow inside the front bulkhead for this purpose. Adding a little weight (probably no more than 10 grams) to the front of your car can add a little more steering, and help the car to jump and little more 'nose low' but without taking away rear traction.

### Wheelbase

Wheelbase can be altered in two different ways (well, there are probably more, but only two common ways). The first is to add a longer, or shorter, chassis to the car. The second is to move the rear axle forward, or backward by relocating spacers on the outer hinge pin. These two adjustments do completely different things. Let's take a look at exactly what.

## **Changing Chassis Length**

Changing your chassis is a major operation. It's not practical in all cars, but is commonly done with some of the major brands. Adding a longer chassis will give you more balance, more stability in high speed corners, slightly more rear traction, slightly slower turn in, better stability on rough tracks, and better jumping. Conversely, adding a shorter chassis will give you more steering and quicker response through corners - particularly when you have to change direction from left to right (and maybe back again). Longer chassis are most often used in a truck, and on bigger, faster tracks. The short chassis option is mostly used only on short, tight, twisty tracks (and usually only with a 2wd buggy).

## **Changing Rear Axle Location**

Most modern R/C buggies have the ability to alter wheelbase by changing the spacing of the rear axle. Some cars have two options (short/long) while others will have a medium wheelbase option. What is important is to recognize that altering wheelbase in this fashion has directly the opposite effect to altering wheelbase by changing chassis length! Why? Because the alteration in wheelbase is so minor, the real effect of altering wheelbase in this fashion is to alter the car's weight distribution. Moving the axle back (longer wheelbase) is, in effect, moving the center of gravity of the car closer to the front axle (almost like moving the battery a little forward). Conversely, moving the axle forward is just like putting more weight over the rear wheels. If you want to know what this adjustment will do to the handling of your car - see Section (7.1) regarding weight distribution. A simple rule of thumb - move the axle forward for more rear traction, backward for less.

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# **Chapter Eight - Transmission/Gearbox**

The transmission of your R/C car is a piece of fine mechanical design and should be maintained carefully. I don't intend to go into great detail here about how to clean, or rebuild transmission components - your instruction manual should cover that. Suffice to say that you should keep bearings, gears and diffs as clean and smooth as possible. Let's take a look at your transmission and see just what kind of tuning options you might have.

## **Gear Ratio**

The primary tuning option relating to your car's transmission is the ability to change gear ratio by using different spur gears or pinions. Before we talk about the effect of gear ratio changes, let's spend a moment sorting out the terminology.

Gear ratios are most often quoted in the form "7.8 to 1". This can be represented in writing as 7.8:1. This means that the motor must rotate 7.8 times for the car's driven wheels to complete one full revolution. Gear ratios can be calculated by dividing the number of teeth on the spur gear by the number of teeth on the pinion and multiplying the result by the internal ratio of the gearbox. Most instruction manuals should tell you the internal ratio of your car's gearbox

The formula for calculating gear ratios looks like this:

$$\text{(# teeth on spur / \# teeth on pinion) X Internal Gearbox Ratio} = \text{Gear Ratio}$$

We've already seen how gear ratios can be represented as numbers (e.g. 7.8:1). The tricky part is in describing ratio changes in general. If you put a bigger pinion on the car, the ratio will change to a small number (say 7.4:1). While the numerical figure has become smaller, the actual gear ratio 7.4:1 is said to be a 'higher' ratio than '7.8:1'. Similarly, moving to a smaller pinion will produce a 'lower' ratio (say 8.2:1). Without wanting to confuse you, changing the spur gear has the opposite effect. A smaller spur gear will result in a 'higher' gear ratio, and a larger spur gear will give you a 'lower' gear ratio. Confused? Stay with me.

Gear ratio changes do a couple of things. Let's look at both the 'lower' and 'higher' gear ratios separately to see what we find.

A lower gear ratio will mostly give you more run time and more acceleration. It's also generally easier on your motor.

A higher gear ratio will generally give you more top speed, and less run time. It's also tougher on your motor. Once you get to a certain ratio point (lets call it the 'optimum ratio') continuing to change to a higher ratio will do nothing but damage. It will result in your motor overheating and being damaged, and in extreme cases, your car may actually go slower.

How's that? Did you understand it all? Have another read, and think about it carefully. Then look at this simple chart, which might help make things clearer.

**Bigger pinion** = smaller spur = higher gear ratio = gearing up = more top speed = less acceleration = less run time = harder on motor

**Smaller pinion** = bigger spur = lower gear ratio = gearing down = less top speed = more acceleration = more run time = better for motor

Hope that helps! For help on choosing your actual gear ratio for any given motor or track, consult your instruction manual, or check with the local fast guys - they'll help you.

## Differential

Your buggy or truck gearbox (transmission) is fitted with a differential. The purpose of the differential is to allow the wheels to turn at slightly different speeds. This is necessary to help the car turn corners. When you car turns a corner, the outside wheel has to travel further than the inside wheel - thus it needs to turn slightly faster to keep up. Differentials (or diffs) in model cars are typical of two kinds. Entry-level cars often use 'gear diffs' while more competition-oriented manufacturers use 'ball diffs'. Both work in the same way, and largely achieve the same thing.

Ball Diffs are, however, slightly adjustable. By slightly increasing or decreasing the tension on the diff screw (see your instruction manual for details on how) you can make the diff 'looser' or 'tighter' A tighter diff is one that is hard to turn. Tighter diffs help your car to put down power coming out of corners and in a straight line, while looser diffs help your car to turn corners better. If you loosen the diff too far, it will allow the diff to slip. Make no mistake - this is a bad thing. Diff slip damages the components of the diff and is inconsistent. Your instruction manual will describe how to tell if your diff is slipping or not. I never recommend running any diff slip - that's what a slipper clutch is for (what's a slipper clutch? Read on).

## Slipper Clutches, Hydradrives and Viscodrives

The slipper clutch, hydradrive and viscodrive all have one aim in mind - to help you put the power to the ground more effectively. Most modern R/C cars (well, the race

oriented ones anyway) come fitted with a slipper clutch as standard. Let's take a look at the use of a slipper clutch, and then the hydra/visco drive option.

### ***Slipper clutches***

Slipper clutches are designed to do exactly what you might think by their name - slip. When you jam on the throttle, the slipper clutch is designed to slip a little before transmitting all that horsepower to your overstressed rear tires. The slipper clutch (or 'clutch' as it's usually known) helps when the track is slippery, or rough, or when you bolt in an enormous motor. The best way to set your clutch is to loosen it right up ('back it off' is the term you'll mostly hear) and place your car on the main straight at your track. When you pull the trigger to accelerate away, the car should move slowly off, with the transmission emitting a loud 'whining' noise. That's the clutch slipping. Now slowly tighten the clutch about 1/2 a turn at a time (trying a full throttle take off after each adjustment) until the clutch only slips for about 3 feet. This is going to be a fairly good setting for most tracks. If the track has particularly high traction, or if you're not having any problems with too much wheelspin - you might even like to run the clutch tighter still. I would recommend against locking the clutch entirely. Just tighten it enough so that there is no slip on acceleration. This will still allow the clutch to slip when your car comes down hard off a jump - or through rough sections of the track - thus protecting the transmission.

### ***Viscodrive & Hydradrive***

The hydradrive and viscodrive basically carry out the same function. If the truth were told, it's not easy to understand exactly how these items perform, but basically, they're like a more advanced version of the slipper clutch. They are designed to assist in smooth delivery of power. Each is fluid filled and adjustable. Each is at its best in rough, or broken track conditions. Each manufacturer provides good instructions on setting up and using their product, or failing that, there are plenty of pro drivers around who can help. My advice to you is to follow the manufacturers instructions to the letter. Leave the hydradrive/viscodrive on at all times unless the track is very smooth and offers high traction. Then you could consider running without it.

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## **Chapter Nine - Choosing & Caring for Your Motor**

Motors are the driving force behind your R/C car. You need to take care of your motor and treat it with respect. In this section, I'll give you some basic, no nonsense guidelines for caring for your motor, and some simple rules for choosing your motor once you graduate into the modified ranks. I'm not a technical guru, and I don't intend to get technical here. Let me just say this. I've raced at the top level of modified in Australia with some success using exactly the simple guidelines I'm going to present to you here. Some may disagree with my assessment, but I'm here to tell you this stuff works in real life - good enough for me.

### **Motor Care**

540 motors are very easy to care for. After each race, brush the loose dirt/dust off the endbell. After every second or third race, add one drop of light machine oil to each bushing (Mobil 1 is ideal but any light machine oil will do the job). After every second race event, take the motor out of the car, and spray it out with R/C motor

cleaner. Don't run the motor while spraying it; don't dip in water, or any other cleaning solvents. When you've finished spraying out the motor, add a drop of oil to each bushing and work the oil in (by turning the shaft by hand a few times). Then add a drop of Break-In fluid or Commutator drops to each brush (inside the motor) and run on a four cell pack for about 30 seconds. Now replace in your car. That's it. Simple, quick, and reliable. If you want more performance from your motor, you can use commutator drops (again, stick with name brands). My advise would be to use them sparingly - certainly only one drop at a time - and preferably only on big race days.

Race Day maintenance of a **modified motor** is not much more difficult than a 540. After about every three races or so, pull the motor from the car. Start by brushing loose dirt from the end bell and can. Next, remove the brush springs and slide the brushes out. Spray a little motor cleaner spray onto a cotton swab, and slide it into the brush hood - pressing firmly to ensure good contact with the commutator. Now rotate the commutator a couple of times. Repeat this process about 3 or 4 times (with clean swabs each time) ensuring that you do both brush hoods. Now get a new cotton swab, and again spray with motor cleaner. Use the cotton swab as a cleaning stick - wiping the face of the brush clean of any debris or carbon build up. Take a very fine pointed file (or a specialist comm cleaning stick) and smooth the sharp edges of the brush. Don't do this on your own for the first time - ask someone experienced to help you. Put the motor back together and back in the car. That's it. Don't oil bearings, or spray out the insides of the motor with spray - you can do more harm than good.

After every second race day (or approximately 10 runs), you should disassemble the motor entirely, and give it a full clean. Here's a basic procedure to follow:

1. Remove the motor from car, brush off any loose dirt/dust.
2. Remove brush springs and slide brushes out of hoods.
3. Take hobby knife and mark the can and end bell to ensure you get the timing right when you re-assemble the motor.
4. Loosen timing ring screws (on top of motor) taking care not to damage the capacitors. Twist endbell and remove from can. Place the complete endbell on a clean, clear section of your workbench next to the brush springs.
5. Take the motor shims off the top of the armature and place next to the endbell. Be sure to make a note of how many spacers there are and what order they may be in. There will probably be a fiber washer closest to the commutator - this is to trap oil and grease that may leak down from the endbell bearing.
6. Remove the armature by hand from the can. Set it aside on the bench after removing any shims from the shaft. Check inside the can for more shims (they'll often fall off the shaft and stick to magnets) and place all shaft end shims together on your clear area. Set the can down next to them (again remember to count how many shims there are on that end).
7. Liberally spray the armature with motor cleaner until runoff is clean (do this over a rubbish bin, or outside - it's not good stuff to get on your carpet). Spray a cotton swab and carefully clean all areas of the commutator.
8. Use a clean tissue to wipe out dust and dirt from inside the motor can and endbell. Do not use spray.

9. Check motor bearings for wear and dirt. To do this, put the armature through the bearing from outside the can or endbell (do one at a time) and spin the armature. If the armature spins freely and quietly - you're fine. If it grinds to a noisy, quick halt - chances are your bearings are either very dirty, or worn out.
10. You can try cleaning your bearings if you like. Remove the bearing from the can/endbell using a motor bearing tool. Then clean as per other bearings in your car. Oil lightly with a good quality bearing oil (Mobil 1 is a good alternative) and replace carefully. If you're not confident about this, ask for help.
11. If you decide that the bearing is worn out (or you try to clean it and it just doesn't improve) then it's time for new bearings. Replacement bearings are available from a number of companies and can be fitted using a motor bearing tool. Again, if you're not confident - ask for help.
12. When you are done with all this - reassemble the motor - taking care to get the shims in the correct location, and put the timing back to the original mark. At this stage I'd recommend fitting new brushes - although if your brushes are still smooth, clean and a nice consistent copper color they're probably ok. Look at the side of the brush - if it is discolored at all (maybe purplish, blue or off-white) then its time to replace the brush - no argument. Solder new brushes on where the old ones come off. As always - ask for help if you're not sure.
13. You're done!

After two cleaning cycles (about 20 runs), I'd recommend that you consider having your commutator re-trued. This is done using a purpose built motor lathe (often with a diamond tip). Lathes can cost between \$300 and \$700 so the odds are you won't have one yourself. Many hobby shops have motor lathes and can do this for you. In fact, a number of hobby shops offer a full motor rebuild service - including clean, re-true and replace brushes. Ask around.

## Modified Motor Brush Selection

When you're using a modified motor you'll quickly discover that there are a range of motor brushes available for you to use. These might be called soft, hard, cut, timed, serrated, silver, copper etc. Pretty confusing. Let's try and give you some very simple guidelines.

### ***Brush compound***

Brushes are known as hard or soft. You might liken brushes to tires. The softer the compound, the greater the performance, but the greater the wear rate. With brushes however, the performance gain is small, and the increase in wear is great. Only when you are seeking the ultimate little extra in horsepower is it worth considering a soft brush. The fact is -they're probably not worth the hassle. You need to clean your motor more often, and change brushes more often - sometimes after just 2 or 3 runs. I recommend that you always use hard compound brushes.

### ***Brush material***

Brushes are a copper color because copper is one of the ingredients of the average brush. There is a whole cocktail of other ingredients that go into every brush. One of

the more common ingredients is silver. Brushes with a high silver content are generally expected to perform better - although as with softer brushes there is usually a trade off for both brush and motor wear. Again, a standard material, standard compound brush is the best choice for consistency and life of the motor.

### ***Brush Shape***

Brushes can come with different shaped (or 'cut') faces. Some have half the face cut away, others have a slot across the center, or a hole drilled in the center. There's even a brush called the 'H Cut' (guess what the face of that looks like!). All of these 'cuts' are designed for different purposes - often for 'stock' racing, or even for on-road. For off-road racing, you are better off sticking to a standard, full-faced brush. Some otherwise full-faced brushes in recent years have a series of small grooves, or serrations across the face. These serrations are designed to help the brush run-in faster. These types of brushes are OK.

### ***Lay Down Brushes***

A standard modified motor uses standard 'upright' brushes. That describes the brush that is taller than it is wide. Some motors are available with 'lay down' brushes (like a normal brush tipped on its side). Additionally, some manufacturers offer 'lay down' conversion kits for standard modified motors. In some conditions, lay down brushes can offer a slight performance gain. It's hard to say when, where and what those conditions exactly are - it's mostly a case of experimentation.

In general, let me say this. I very, very rarely use anything other than a standard, full faced, hard, upright brush. Many, many races around the world are won with this type of brush - and you will never go wrong.

## **Motor Selection**

In 540, or spec classes, motor choice is very, very easy. Just take it out of the box and bolt it into the car. That's it. When you're racing modified however, it's a whole different story. Choice in motor wind is almost infinite and there are certainly no hard, fast rules. There are, however, some general guidelines to help you choose a good strong motor. Remember - these guidelines are general only - there will always be exceptions.

The less turns of wire on a motor (e.g. 11 turns compared to 15 turns), the faster it will generally be. However, it will also be generally tougher on batteries, and harder to drive. Higher turn motors will be easier on batteries, and generate more torque - allowing you to gear higher.

The more strands of wire on a motor (e.g. triple compared to double), the more top end it will generally have (very general statements here). A multi-strand motor will generally be easier on batteries, and smoother to accelerate. You will generally be able to gear it higher (thus the higher top speed). But (and it's a BIG but) you probably won't get stump-pulling acceleration out of it. That's where low strand count motors are strong (singles and double). I have to stress this again - this is a very general understanding.

In years gone by, the choices were fairly simple. The more power you wanted, the lower the number of turns, and strands you opted for. Something like an 11 Double would have been considered to be an enormous motor. That is no longer true. New motor winding technology has meant that multi-strand motors like 15\*6 or 11\*7 are

more common (and incredibly fast). Still, here's a rough guide to motors for each class:

### **2wd**

When you're choosing a 2wd motor, steer clear of stump-pulling torque. Remember you've only got two tires in contact with the ground. Try to run multi-wind motors like triples, or quads (or even quin or sextuples) and generally stay around the 11-12-13 turn range (once you've got some experience). For tighter tracks, or higher grip, you might try a 12 double. When you first start out, a 13 Triple or Quad will be an excellent, consistent choice.

### **4wd**

For four wheel drive - you need a little more grunt. This is exactly where double (and sometimes single) wind motors come in handy. Try an 11 or 12 turn double. Remember though, 4wd is tougher on batteries - you'll need to use a lower gear ratio than with an equivalent motor in your 2wd. If you've got RC2000 cells and want ultimate horsepower - seriously consider something in the 10 turn range - probably a triple or quad. Save this last option for when you've done heaps of practice.

### **Truck**

Like the 4wd, trucks demand a little more from your motor than the 2wd. Often you'll need to run a double, or maybe triple wind motor. For trucks try to stay in the 12 to 13 turn range. You'll get the best combination of performance and run time. Really low turn motors (10, 11) struggle in a truck because of the very high load involved. You'll chew through brushes and wear out your motor like you won't believe if you stray too low in turns.

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## **Chapter Ten - Driving the Beast**

After all this effort of setting up your car, you've still got to drive it. If I could tell you exactly how to become a perfect driver, I'd be a pro racer on my way to the Worlds. The fact is we can't all drive like the pros. We can, however, all improve ourselves. Here are a few tips to keep in mind when you're striving to improve your driving:

### **1. Know exactly where you want to drive.**

Sounds simple doesn't it. This means - go for a walk around the track before racing starts - look out for nasty holes or bumps - figure out where to hit the jumps and exactly (like down to the inch) what you want your racing line to be. When you go out to drive, try to remember everything that you decided on earlier. Don't try and think of the whole track in one go - just concentrate on the corner you're on now and the next 2 or three corners. If you notice yourself getting off your chosen line - it's easy to fix - SLOW DOWN until you're back where you want to be.

## **2. When you have your first run at a new track, take the first few laps slowly.**

Try different lines - figure out where your car is best over the jumps and bumps. If you're having trouble on one particular jump try different lines, different throttle openings - keep experimenting until you have a method of consistently negotiating the whole track.

## **3. Watch others drive.**

Next time you're at a big race, take some time to watch the 2wd or 4wd modified races. Pick out the fast guys and watch them closely. Look at the lines they take, listen for their throttle movements (especially when the car is in the air). I'll guarantee you - they will be smooth on the throttle, and gentle with the steering. They'll also be utterly consistent. What you need to learn is this - if your car is consistently on your chosen racing line - you'll never crash, and you'll win more than you'll lose. Simple huh?

## **4. If you're attending a big race**

Try to draw out a complete map of the track on paper. Mark in corners, jumps, ruts, holes and bumps. Mark in your preferred line and make notes to yourself about things to remember for each corner or jump. Take it home, and spend a little time the night before the race just reading through the comments - memorizing the whole track - exactly as you want to drive it.

## **5. You must practice!**

Race on your own, get to club races, drive with other (and better) drivers, race on-road whatever. The more you drive, the better you will drive - provided that you think about what you are doing and strive to improve.

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# Chapter Eleven - Money

R/C car racing can be a bottomless pit for your money if you let it. My advice to you is to think very carefully before you spend your hard earned bucks on new gear. It is better to be careful with your spending, enjoy your racing and stay in the sport for many years, than to spend heaps of money, become disillusioned and give up after a few months.

Don't rush out to buy every option part manufactured for your car. Good car performance is much more a case of practice and hard work, than it is a case of spending money indiscriminately. There are certainly things you should consider buying - but be sensible and approach it from a cost benefit basis. Here's a rough priority for spending money on your car:

1. **Ball bearings for wheels and transmission.** Bearings will enhance run time, performance, reliability and strength. If your car doesn't have them - they are your first priority.
2. **Spare batteries and radio crystals.** If you're racing with just one battery, you should make it a priority to get a couple more. Three is OK, but five (enough so that you have a fresh pack for each race on each race day) is ideal. You don't need high dollar matched packs. While we're

on the topic of electronics - pick up a spare set of radio crystals as well. To race you'll need at least two pairs - preferably three. They're cheap - and if you look after them they'll last a long time.

3. **Spare pinion/spur gears.** The ability to alter gear ratio is very important. Pinions and spurs are relatively cheap - always carry a range.
4. **Spare Tires.** Tires are a very important (possibly the most important) tuning tool you have. As you can afford it - try to build up a range of tire choices
5. **Electronic Speed Control.** If you're struggling with a manual speed control - this will turn your life around. Electronics give more power, more run time, and much more reliability. Best of all, if you sell your old car, you can move your electronic speed control straight into your new one.
6. **Spare springs/shock oil.** Most manufacturers offer a choice of softer, or stiffer springs for your car. Pick up some optional springs and shock oil to help you tune it. Usually it's best to get the spring/shock oil that is slightly softer, and slightly stiffer than the kit parts.
7. **Reliability Parts.** By reliability parts, I mean items that will make your car to be stronger, break down less, or be more consistent - not necessarily to perform better. Things like titanium turnbuckles, or 'captive' ball joints.
8. **Performance Parts.** Performance parts are items that help your car to run better or more efficiently. Lightweight transmission parts, optional graphite chassis parts, different tuning options such as anti-roll bars, or different toe/anti-squat blocks.
9. **Appearance Parts.** If you've still got money left over - you might want to make your car look better. Anodized aluminum screw sets, different bodies, wings, wheels, sticker sets, etc. The options are almost endless.

Let me say one more thing on this topic. If you're running a cheap low-end buggy not specifically made for racing, it's best for you not to spend too much money trying to hop up your buggy and make it competitive. Instead you should concentrate on saving for a better car. Even a well looked after second hand racecar is a good investment. If you want to go faster - concentrate on items that you can move into another car if/when you save the \$\$\$\$. Things like batteries, electronic speed controls, radio gear etc.

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## Chapter Twelve - Electronics & Radio Gear

One important policy I've always used when buying electronic gear is to get the absolute best equipment I can afford. Electronic gear is not cheap - and you don't want to have to replace it after a year or so if you find that your gear is not up to the task. A good quality electronic setup will last a long time - and deliver good performance. You don't need to buy the ultimate top of the line equipment - but good mid-range gear that is from a name, quality manufacturer. Here's a suggested list for your consideration:

One other important note about radio/electronics: the manufacturers who've built your equipment understand everything about it. They designed it, built it, service it,

etc. Listen to their instructions. The instruction sheet/booklet you got with your gear is the only advice you should listen to!

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## Chapter Thirteen - Where to from Here?

We've covered a lot of ground in these pages. You might not have understood it all, and you almost certainly won't remember it all. Let me encourage you to go back to Section 3 and seek to follow the basic guidelines we presented there. Use this book as a reference, but remember, there is no substitute for practice, and personal experience. Don't believe something just because I tell you it's true. Go out and prove, or disprove, it for yourself.

Most of all, remember that R/C racing is an enjoyable activity. I'm not trying to take that joy away by making it all hard work - just to help you to get your car going a little better, and to therefore enjoy it more. The most enjoyable races for me are those when my car handles just like I want it to. The search to make every race like that has led me to collecting the information that's contained in this book.

If you need more help, again let me encourage you - just ask. Ask the guy pitting next to you, ask the local pro. If you want parts or accessories for your car contact your local R/C shop - preferably one that supports racing at your local club or track.

I hope you've enjoyed reading this book and I hope it helps you to enjoy your R/C racing more. I wish you every success in your R/C career.

Scott Guyatt

# Glossary of Terms

## Wheelbase

Wheelbase is the distance between the front and rear axles of your car

## Toe

Toe is the angle of the wheels in relation to the centerline of the chassis. Toe-in refers to the setting when the wheels point 'inward' whilst Toe-out refers to the setting when the wheels point 'outward'. You can check 'Toe' by placing a ruler against each wheel - if the ruler points inward - that's Toe-In.

## Sway Bar

See (Anti-Roll Bar)

## Shocks

The shocks, shock absorbers, or dampers are silicon oil filled 'cylinders' used to slow the motion of the springs supporting the car's suspension. Shock absorbers can generally be adjusted by either altering the internal configuration (see Piston) or by using oil of differing viscosity (or 'thickness').

## Ride Height

Ride Height refers to the distance between the ground and the bottom of your car's chassis when it is at rest. To check ride height - work your car's suspension up and down a few times, then drop it onto a flat surface from a height of about 12 inches. Some manufacturers will give you a reference point for checking ride height - e.g. Rear suspension arms level, or Drive shafts level. This can help you easily compare your ride height settings time after time.

## Pistons

A piston is a crucial part of the internal mechanism of a shock absorber. The piston is mounted on the end of the 'shock shaft' and is typically a thin plastic disc with a number of holes drilled in it. Changing the piston for one with either larger, or smaller holes or a different number of holes can have a dramatic effect on the performance of the shock absorber.

## Drop

To put in simply, drop refers to the amount your suspension arms hang down

## Caster

A hard one to explain! Caster refers to the angle of the front king pin in relation to the vertical. The king pin may be either a solid pin, or imaginary line through the center of the steering block. Castor is measured in degrees and generally refers to the angle which the king pin leans back from the front of the car. A typical castor angle for a two-wheel drive buggy or truck is 25 degrees. A four-wheel drive buggy may vary from 5 to 20 degrees.

## Camber

Camber refers to the angle of a wheel in relation to the vertical (perpendicular). 'Negative' camber means that the top of the wheel leans in towards the center of the car, whilst 'Positive' camber refers to the situation when the top of the wheel leans out - away from the center of the car.

## Anti-Squat

See also (Caster). Anti-squat is generally used on the rear suspension of the car and refers to the angle of the rear suspension arm hinge pins in relation to the chassis.

## Anti-Roll Bar

An anti-roll bar is a wire device fitted to the car which limits, or prevents the car 'body rolling' from side to side through corners.

## 3D Acceleration

3D operations require huge amounts of calculations. Recently, hardware cards have been developed to offload many of these calculations to the card rather than your computer's CPU.

## ATV

Amount of servo travel. For instance, 50% ATV would mean the servo's maximum travel is 50% of its physical limit.

## Auto-Play

Automatically detects when a CD-ROM is inserted and runs the specific program on the CD-ROM.

## Bilinear Textures

Smooths textured pixels together. This can give it a blurry appearance but can also make it look better.

## **CG**

Center of Gravity.

## **Control Panel**

A program that is included with Windows 95/98. This is easily accessible via the START menu.

## **Controller**

The pistol type controller that allows you control the car in RealRace.

## **Controller**

RealRace™ includes a genuine Futaba ® pistol-grip controller to add to the Realism. Controller Page.

## **Controller**

A device that connects to your computer that is used to control the car.

## **Direct3D Technology**

Used to render the 3D image when you have an accelerated graphics card. It works best on faster computers.

## **DirectX**

A technology created by Microsoft that accelerates graphics and sound operations.

## **Dithering**

Blends the pixels together to produce a smoother image. This can also simulate colors which may not be available to you.

## **Full Edit**

Allows you to edit every single parameter about the car. This is for advanced users or adventurous novices. You will not be able to race a "Full Edited" car in a "spec race."

This prevents racers from putting a .21 engine in a .10 truck race! If the Race Manager allows unlimited racing, then you can race a car that has been modified using the Full Edit feature.

## **Gouraud Shading**

Smooths the intensity from one corner of a polygon to another corner. Causing objects to look "smooth."

## ***HAL Device***

A hardware accelerated 3D Driver

## **Internal 3D Technology**

Used by RealRace to render the 3D image quickly and without the help of a 3D accelerated graphics card. Also faster when used with slower computers.

## **Knife Edge Software**

Creator of RealRace(tm) and RealFlight(tm)

## **LAN**

Local Area Network. This is usually a network where the computers are connected with high speed network cards.

## **Low Rates**

A switch on the radio that makes the servos move to much smaller extremes, thus making the model respond slower.

## **Quick Edit**

Only allows select parameters to be edited. These are parameters that are likely to be changed on a car by a racer.

This is for Novice and Advanced users.

Vehicles that have been modified using the Quick Edit feature may be utilized in either a "spec" Race or an Unlimited Race.

## **RAM**

Random Access Memory

## **RAMP**

A software only renderer that is usually faster than the RGB rendered at the expense of quality.

## **RealPhysics™**

The technology that reproduces the flight characteristics of the car using real aerodynamic physics formulas.

## **RealRace™**

The Professional R/C Car Simulator produced by DuraTrax.

## **Resolution**

When used in the context of screen resolution, this term defines the picture quality of the screen. Lower resolutions will produce an image that is not as sharp as higher resolutions.

## **Simulator Settings**

Defines all the graphics, sound, and input preferences for RealRace. Accessible by clicking "Simulator Settings" on the main screen.

## **Sound Card**

A card that plugs into your motherboard which reproduces audio through your speakers.

## **Specular Highlights**

Makes surfaces reflect sunlight.

## **Video Card**

A card that plugs into your motherboard that produces the video images on your monitor. Recently, 3D video cards have accelerated 3D operations as well.

## **VirtualRevolution™**

The technology that plays the sound of the engines using real CD-quality audio samples.



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