IndyCar Racing

from

Papyrus Publishing, Inc.

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A Quick Lap Around New Hampshire

Chances are there are some IndyCar pilots who'd rather jump into the seat of their racecar with as little instruction as possible. It is with these drivers in mind that we bring you a quick rookie's course on basic car control, requiring a minimal amount of reading. Later, you may wish to refer back to this manual as you begin to crave a more intensive IndyCar experience.

First, you'll need to know how to make simple selections within the various game menus available. If you have a joystick, you can scroll through the options by pulling up or down to highlight your choice, then push joystick button A. If you are using the keyboard, highlight your selections with the cursor up/down keys, then press enter.

From the main menu, choose **Preseason Testing**. Next you will see a list of available tracks. Select **New Hampshire,** a speedway located in Loudon, New Hampshire. This track offers a good venue from which to begin your IndyCar Racing career. It is a short oval that measures just over a mile in length, and has four equally matched turns banked at twelve degrees. In preseason testing, you'll have an unlimited session which will allow you to hone your skills on a closed course.

Upon selecting the track, choose **Practice** from the **Preseason Testing** menu. You'll be seated inside your IndyCar in the pits, ready to go. You're driving the blue and white car bearing the IndyCar logo and the number "0." The **Pit** menu can be used to instruct your crew on any setup changes you want on the car before going out onto the track. This menu appears anytime you stop in your pit, between your pit crew. For now, choose "done" from the **Pit** menu to begin racing.

For your first laps, your goal should be to maintain control while establishing a feel for your IndyCar. To help achieve this, you should reduce your turbocharger to a lower setting (6) before leaving your pit area. Press the number 6 key at the top of the keyboard. (Your boost indicator will show "6" on the panel.)

If you have a joystick, button **A** is your accelerator, **B** is the brake. (Use the keyboard cursor keys if you do not own a joystick). Slowly drive down the pit lane, easing the car out to the right hand side.

As you leave the pit lane and enter the track, feather the throttle and try not to let the car get too wide. Too much power too soon, and you'll learn exactly where the wall is at Loudon.

Along the back straight, you'll have time to glance at your instrumentation. Try to keep the car just to the right of center down the straight, in order to set up for an outside run into turn three.

As you approach the end of the straight, dive down low to the left, clipping the safety stripe with your left tires. The car will slide out to the right and exit the turn cleanly near the wall (provided you are not going too fast!). In turn four (shown at left) you will see the entrance to the pit lane. Stay to the right if you want to get some more miles under your belt.

Streaking down the front straight now, cross the start/finish line and your pit board is displayed in the upper left corner, giving you the time of your current lap along with your best lap. And that's it! Congratulations, you're now an IndyCar driver!

Menus And Basics

The Main Menu Screen

When you first load IndyCar Racing, you will see a brief introduction, then be taken to the main menu. From this menu, you are presented with several options. Use your joystick, mouse or keyboard to select your choice.

Single Race: This allows you to configure your car and qualify for a race at any IndyCar Racing track available on your computer. This race will not be included in any seasonal results, nor will it affect any point standings you may currently own in a championship season. It's a good idea to choose the **Options** button first, in order to calibrate your joystick or other control device, as well as make other critical decisions such as race distance and realism settings.

Championship Season This is it, the real thing. You'll be called upon to come up with a fast racing setup on a variety of tracks. Meanwhile the other world-renowned drivers will be looking to wear the crown of IndyCar champion. You will compete for points in a full season of tire-smoking, engine-grinding events spanning the entire North American continent. You'll have to know every bump and turn of each racetrack, as well as your opponents' tendencies. You may be a master on a closed road course, but you've got to have it together on the ovals, too!

Preseason Testing Actual races are no time to be experimenting with racecar setups and driving styles. These can be honed to perfection by driving many test miles, logged on the track of your choice. Select the site and drive as many laps as you wish, painlessly concocting a winning combination of track knowledge and chassis setup.

Cars: Use this option to decide what type of engine/chassis package you'll drive, what name you wish to have on your IndyCar race driver's license, and to get a good look at your opponents' cars and personal origins.

Options: From here you can setup and modify a number of the simulation's parameters chosen from the **Options** menu are automatically saved to disk by the program. **Race Distance**, for example, will always reflect the most recent change made. Suppose you set your race distance to 50%. Each time you load and play IndyCar racing, your race lengths will be 50% of the actual races' lengths, until you decide to change **Race Distance** again from the **Options** menu.

The Options Menu

Upon selecting **Options** from the main menu, you will be presented with the screen shown above.

Choosing **Controls** will unveil a menu that allows you to calibrate your joystick device, and configure it along with the keyboard in any manner you wish. Want to accelerate using the spacebar? No problem. Want to shift your own gears using the joystick buttons, or two keys on your keyboard? Go ahead, it's your racecar! You can also decide whether to use automatic transmission & braking (generally helpful for rookies), or to perform these tasks yourself. Wheel users and some yoke users will want to select linear steering, joystick users should choose non-linear steering.

The **Realism** menu (selected on the **Options** menu) lets you decide just how far inside the sport of auto racing you wish to explore.

Picking your race distance is very important. Since IndyCar Racing is a complex, real time simulation, you will need two to three hours to complete each event if you elect to the full distance (100%). However, if you have grass to mow or relatives to visit you can still squeeze a race or two in by simply choosing a shorter distance.

Other options contained on the **Realism** menu permit you to toggle yellow caution flags on or off, allow car damage, and determine what kind of weather conditions will be in effect.

The remaining preferences on the **Options** menu allow you to load new cars as they become available (opponents), and tailor graphic detail and game sounds to your computer system.

The Single Race Menu

This menu contains all of the selections necessary to compete in a single event. Begin by choosing **Single race** from the main menu. You will then be presented with the opportunity to race any of the authentic IndyCar tracks you own a copy of. After selecting the site of the race and viewing track information, the menu screen shown above will appear, giving you total control of the simulation's parameters. This race will not be counted in any seasonal points competition and therefore offers the best method of honing your race engineering and driving skills, without the crown of IndyCar champion at risk.

Note: You can gain access to this menu at any time during a race by simply pressing the escape key.

Replay: Choosing this option lets you relive your most glorious moments in racing. VCR-like controls allow you to shuttle the replay footage forward or back, switch to another camera angle, or ride onboard with another driver!

Garage: Highlighting this selection sends you to your team's trackside shop. Off limits to media-types and other teams, it is here that you will begin your IndyCar dynasty. In order to dominate on the track, you've got to formulate a racing setup that best compliments your driving style.

Practice: There are many other IndyCar drivers who want the checkered flag as much as you do. In order to be the best, you'll need to ring up some serious mileage on your IndyCar. You can sharpen up on every vital moment that may occur in a race, from hitting your pits to learning your way around an unfamiliar circuit.

Next Session (Qualify): When you're ready for the "show" pick up this option to make a qualifying attempt. After you are shown a description of the qualifying requirements, you will start in your pit, with the most recently chosen chassis tunings on your car. Qualification requirements differ from track to track. Skipping this session altogether automatically places you at the rear of the race's starting grid.

Next Session (Warm up): It's always smart to click off a few last-minute laps, in order to make sure your car setups are working as you planned. While you're here, make sure you refuel for the actual race, since you probably qualified with a near-empty tank.

Next Session (Race): After qualifying, choose the garage menu again to remove qualifying setups from your car, and replace them with your racing setup. When you choose **Race** you will be in your car, on the starting grid. The race distance and realism levels will be based upon your selections made under **Options** on the **Main** menu.

Leave Track: This choice gets you out of town faster than your IndyCar could, and deposits you back at the main menu screen.

The Championship Season

Those who desire the ultimate in an auto racing simulation may wish to compete in full season of IndyCar events. If you select a **Championship Season** from the main menu, you will be presented with tow options. You can begin a new season, or resume the ongoing season previously saved to disk IndyCar Racing will only allow you to keep one championship season on disk at a time.

In a championship season, you'll contest each event in order of actual occurrence on the IndyCar circuit. IndyCar Racing automatically compose seasons based on all tracks that are currently installed on your system. Points are awarded at the conclusion of each race, according to the final results:

1st..20
2nd..16
3rd..14
4th.. 12
5th..10
6th..8
7th..6
8th..5
9th..4
10th..2
11th..1
12th..1
Fastest Qualifier...1
Most Laps Led...1

At the conclusion of the last event on the schedule, the driver who has accrued the highest point total is declared IndyCar Racing Champion.

The Instant Replay

We know how it is out there. You're on the track, screaming down straights, slicing through corners at insanely fast speeds. All of your moves, passes and crashes become melded into one gasping blur. If not for the magic of television, these moments would be lost forever, never to be used to impress your friends and wow potential sponsors. However, network coverage of racing has become a sophisticated as the racecars themselves. IndyCar Racing makes viewing television replays of all the action easier than popping a tape into your **VCR!**

To watch multi-camera footage from the track, press the escape key. After viewing driver's current positions, press any key to bring up the race menu. Choosing **Replay** from this screen takes you to the most recent video replay footage, along with VCR-like controls.

A "VCR command bar" appears at the bottom of every replay screen. Just above the bar, the running time of your footage is displayed. The upper right corner shows the camera angle you are currently viewing.

Although most of the buttons found on the control bar operate like those on conventional VCR's, some of these buttons perform multiple functions.

The Camera Selection Button

When this button is highlighted, each press of the joystick button switches the replay view to the next camera angle. "TV" angles provide the same type of race coverage viewers at home would see. Camera angles are automatically switched from one to another by the network director, in order to offer the most interesting viewpoints. Other camera angles originate from your car itself, or lock their viewfinders on the selected care and follow it constantly around the track. Each IndyCar in the simulation carries two cameras onboard, one mounted beside the driver's right ear on the rollbar, and the other affixed to the gearbox, shooting an "out-the-rear" perspective.

The Car Selection Button

Not only does IndyCar Racing offer you a multitude of camera angles, but you can also view them from any car. When this button is highlighted, each press of the joystick button witches the replay focus to another car, allowing you to review your blazing passes through the eyes of your vanquished rival.

Start From The Beginning

With a single press of this button, you can instantly rewind the replay tape to its head, and see all of the footage that is currently loaded.

Rewind/Search Button

A dual-function button when highlighted. Short, quick presses of the joystick button allow you to step frame-by-frame backward through the tape. Hold down the joystick button to perform a standard high-speed rewind while viewing the footage.

Play/Pause Button

Operate this button to start or stop the replay tape at any point. If the footage is moving, a click of this button will pause it. With a second click of this button, your replay footage is running forward again at normal play speed.

Fast Forward Button

Want to skip the methodical, lap-by-lap stuff and just see the key moves? Use this button to spin forward quickly to any point in the replay tape you wish. Additionally, like the rewind button you can step through the footage a frame at a time by clicking your joystick button on fast forward in short bursts. Press and hold the joystick button to execute a full motion fast forward.

Disk Utilities Icon

Clicking on this button shows you three disk tools that allow you to save replays to disk, recall previously stored replays, or delete from disk old replays you no longer wish to keep.

Racing and Television Coverage

For years, auto racing enthusiasts were subjected to mediocre production values, while football, baseball and even golf fans were treated to state-of-the-art television. But with the advent of cable TV, racing buffs had the catalyst they needed to bring about revolution. Networks began to recognize racing fans in a more serious light, paying heed to their long-suffering cries for better coverage.

The results are evident today. A typical network will cover a racetrack with about twenty-five cameras. During practice sessions, camera operators will follow a car around a full lap. If the car disappears from view at any time, cameras may either be repositioned or added. The television crew will unroll miles of video cable that must be strung about the track to connect each camera.

One of the brightest additions to any racing broadcast has to be use of in-car cameras. It takes less than two hours for television engineers to install as many as four cameras in a single IndyCar. They all connect to a single swithbox located beneath the driver's seat. These cameras are about the size of a man's thumb and therefore nicknamed "lipstick" cameras. Each camera bolts securely to a sturdy part of the car's framework, whether it be the gearbox or a roller. By tightly fastening each camera, any vibration felt by the car will also be felt by the camera. Since the car and camera bounce in unison, the viewer is treated to a reasonably steady picture.

All of the in-car cameras are wireless, feeding live pictures back to the TV truck via radio antenna. The networks uses a helicopter bearing the main receiving antenna (called a "repeater") to get the in-car video from the track to the truck. This helicopter must hover high above the raceway to produce clear, interference-free pictures. The chopper can stay airborne for about three-and-a-half hours before touching down to refuel. This window of time easily fits well with most IndyCar races!

Sometimes the in-car camera lenses become dirty or hazy. To counteract this, a strip of clear acetate is rolled on sprockets, like film. The acetate stretches across the lens, and when it becomes soiled, the television crew merely uses a remote control signal to wind a new transparent section across the viewer's screen.

Product sponsors have also been the benefactors of this technology. It is no accident that logos routinely appear in shots taken from these in-car-cameras. Primary sponsors make every effort to ensure their labels are clearly displayed in the foreground of these pictures, even if it means sticking their decals to a CV joint for the gearbox camera!

Thanks to the efforts of some of the major auto makers, telemetric data from the racecar is beginning to make its way into the broadcast coverage. The networks currently earmark a couple of teams per race to carry the onboard telemetry devices. Television viewers not only have the opportunity to "ride along" with IndyCar drivers, they also get to see data such as speed, engine rpms and gear selection graphically displayed on screen.

Cockpit Features And Controls

Behind The Wheel

If you were to climb behind the wheel of an actual IndyCar, the first thing you'd find surprising would be the overall size of the cockpit. A driver of average build fits very snugly in the seat, the sides of the car practically wrapping around his shoulders. Some drivers have to twist their upper bodies sideways as they climb in or out of the car.

Ordinarily, the IndyCar steering wheel is a mere seven or eight inches in diameter, and your rear view mirrors are only three inches wide. The fingertip levers that control brake bias and anti-roll adjustments are about the size of a number-two pencil with a grape on top! Chances are your joystick is larger than a typical IndyCar's gear shift lever.

Also, in the interest of weight reduction, the driver's seat is made from perforated carbon fiber, with little or no padding. Imagine driving the family car for more than five hundred miles, all the while perched on a fiberglass patio seat! The IndyCar driver definitely earns his stripes for durability.

This economization of space stems from the team's goal of producing the fastest racecar in the sleekest, lightest package possible. In other words, "If we don't need it, why take it with us?" Interior comfort and style are insignificant issues in the competitive racing world.

Your In-Car Controls

Rear View Mirror   *Black Box Display*   *Rear View Mirror*

Anti-Roll/Bias Adjusts   *Gear Shift*

Adjusting Anti-Roll Bars & Brake Bias

Make your front anti-roll bar adjustments with these keys. You will see the front anti-roll lever move forward or back, and the lighted indicator details your exact position.

The left lever controls the front anti-roll bar. The middle lever adjusts the rear anti-roll bar. The large lever on the right sets the brake bias.

Set your rear anti-roll bar to the desired stiffness with these two keys. The rear anti-roll bar lever will move back-and-forth, corresponding with your keystrokes. The red lighted indicator on the panel displays your current anti-roll bar setting. Both anti-roll bars may be readjusted as you drive, allowing you to compensate for constant changes in your IndyCar's handling. (See information on anti-roll bar adjustments in the tuning section.)

You can control your brake bias from inside the car as you drive, via these two keys. As you move the lever, the yellow indicator light shows you the current bias position. As the light shifts upward, bias is being moved forward, and the lever will slide forward in unison. When your keystrokes pull the lever back, the lighted display will move down to convey bias being moved rearward. These setting can be manipulated as you drive.

Something new in the IndyCar: Digital displays efficiently offer the driver "at-a-glance-access" to the exact position of the anti-roll bar and bias settings, allowing his eyes to stay focused on the action ahead.

Cockpit Instrumentation

Tachometer (graphic): Strategically located at the base of the driver's sight line, this graph accurately reproduces the engine's current rpm output. At 180mph in traffic, this display is much easier to read than the numeric version, though not quite as accurate. It is also nicknamed the "tach strip."

Speedometer: This big, bold display gives you your current speed. It is located just below the tach strip so they can be read together. It is important to note that the speedometer in your IndyCar is not the best measuring stick of overall performance. It simply provides another useful reference point for the driver and his team. The tachometer is still the most reliable indicator of how your IndyCar is performing, and what it is capable of.

Tachometer (numeric): Winning IndyCar teams pay great attention to detail. While the tach strip is quite handy in the throws of competition, the numeric tachometer gives you precise rpm calculations taken directly from your engine. These figures may prove to be quite useful to you, particularly during preseason testing or practice sessions.

Fuel & Engine Warnings: These lights are designed to blink warnings to the driver under certain conditions. The fuel light (yellow) will begin to flash repeatedly when your gauge shows five gallons or less of methanol remaining. You should have an idea of how many additional laps you can squeeze in before you absolutely must pit for fuel. This number will vary, depending upon track distances and racecar setups in use. The engine light (red) flickers when an over-revving condition occurs. Generally, you'll need to lower your turbo boost pressure to remedy this situation. You may also find it necessary to retune your gear ratios to a setup better suited for that racetrack. If this light stays on unattended, you could blow your IndyCar's engine and be forced to walk back to the pits.

Turbo Boost: This figure shows you how hard your turbocharger is working, by indicating "manifold absolute pressure." Painstakingly measured in inches of mercury, the maximum legal limit in IndyCar racing is 45 in./Hg, or 22 psi. Note that the figure on your display is not fixed in position by your turbocharger control. Instead, it fluctuates to represent the constant boost changes drawn by the engine to maintain horsepower.

Fuel Gauge: The fuel cell in your IndyCar has a forty gallon capacity. This gauge is extremely accurate, no matter what attitude your IndyCar undergoes. Unlike the conventional "float type" fuel gauges, your IndyCar's onboard computer measures remaining fuel through flow-rate sensors.

Engine Temp: This gives you the current engine coolant temperature readout. This number is critical to determining your engine's reliability, as well as trouble shooting setup problems. While you may "boil the oil" during testing or practice, you should have your raceday setups honed to eliminate any overheating whatsoever.

Current Gear: A new development in IndyCar Racing, the Papyrus racing team designed this tool specifically for your car. It shows you the current gear in use at a glance, enabling you to drive without concentrating on the position of the gear shift lever.

Whether you opt for an auto-shifting transmission, or the more realistic manual version, the key to smooth driving lies in executing precise gear changes. Know at all times what gear you are in, and what gear you need to be in. Great drivers memorize each "gear change point" on the track, so that they can transition through the gearbox without missing a beat.

Note: Select between manual or automatic shifting, and configure car controls (ie. shifting, steering, etc.) to your specifications by choosing "Options" at the main menu.

The Black Box Modes

In addition to the normal black box display, you can also retrieve up to the minute tire temperatures from your chassis. This data will help you determine which tires are working the hardest, as well as pointing out any potential weaknesses in tire and chassis setup. Your black box will also calculate fuel economy readings, and display them as you drive. The fuel mode also discloses the number of laps you can complete before running out of fuel.

To toggle your black box mode, tap the "f2: key. Each press of the "f2" key changes the screen on your black box between the three available modes. Remember, you are still driving while viewing this data. Look for special moments during the race, such as a long straightway or light traffic to check these readings.

Checking The Leaderboard

From behind the wheel of your IndyCar, you can display a race standings chart on screen at any time. Pressing the "f1" key toggles the standings on or off. You can cycle through the entire list of drivers to see who occupies each position by pressing the less than/greater than keys (< or >). Along with the position of each driver in the race, you'll also see the current status of each car. If a car is still active, the interval between this car and the race leader will be displayed. If a car has retired from the race, the exact nature of failure (crash or mechanical) will be exhibited on the Leaderboard.

When you are racing, you may suspend the action at any time by pressing the **"P"** key. This freezes the race immediately, affording you with the opportunity to answer the phone or grab a snack. Strike the **"P"** key a second time when you are ready to resume racing. You may also use the escape key to temporarily exit a race. You will see a current result screen similar to the one shown above, upon escaping. Use the keyboard or your joystick to cycle through the list of driver's names and positions at your discretion. Press the enter key or joystick button to move to the race menu, where you'll have the opportunity to watch an instant replay or exit back to the main menu.

Final Instructions From Your Pit

You've looked over the primary menus, read some of the manual and calibrated your joystick. Now you feel the urge to satisfy your true passion, which happens to be thrusting an IndyCar down an open stretch of track at over **200** mph! Maybe you've already seen sampled a lap or two out of unquenchable curiosity. Here are just a few last minute instructions from you crew before screeching off toward victory lane.

Your anti-roll bars, brake bias, boost setting and black box mode can be adjusted form inside the cockpit, as you drive. These selections are all made from the keyboard, with permanent keys assigned to each one. It's a good idea to reduce your turbocharger setting to a lower setting while you are learning the game. It is much more important for any IndyCar driver to maintain car control than it is to go fast.

When you exit your pit, the amount of traffic will vary depending upon the type of session you selected. If you chose **Preseason Testing** for example, you won't have any other drivers on the track to contend with. Papyrus Racing urges you to log several hundred miles in the preseason if you wish to command the throne of IndyCar Champion by year's end. If you choose one of the racing options, you will be maneuvering against limited traffic during the practice session, giving you a taste of how your skills behind the wheel measure up to the other drivers.

If you're new to the IndyCar Racing game, you may want to stay with **No Car Damage,** selected from within the **Realism** menu, then opt for some preseason testing. This feature will allow you to experiment with car setups and driving styles in a worry-free manner while you are learning the ropes.

How To Read Your Pit Board

After each lap, your crew will display a pit board in the upper left corner of the screen. For example, Justin Tyme is currently in 29th place with one lap remaining. His average speed (149.734 mph) for the most recently completed lap is displayed (On road courses this would be lap time instead). He trails car #90 by two-tenths of a second. If he were the race leader, the interval would show how far ahead he was.

The IndyCar Circuit

"Which Way Is The Ocean, Dude?"

The IndyCar events at Long Beach have helped transform this once dull town into one of American racing's glamour spots. Generally one of the early races on the calendar, it's an important location to establish one's domination.

Grand Prix Of Long Beach

Circuit Type: Temporary Street
Circuit Length: 1.590 Miles
100% Race Distance: 166.95 Miles (105 Laps)

Set amidst pavilions and bustling convention centers, this event showcases the city of Long Beach, California to the American racing public. This racetrack is one of the most challenging courses on the IndyCar Racing circuit. A true test of driving skill, Long Beach has two long straightaways connected to several tight first and second gear bends. The track itself is flat, wide and exhilarating.

If the weather is dry, most teams will opt for little wing in order to reach high speeds down the two long straights. Top speed on the car beyond 180 mph will most likely be wasted however, with a key to good lap times being how fast you can get through the shorter straights as well.

In wet conditions, the game plan changes for most teams as they look for additional downforce to take on the slippery corner. Though this means conceding the two long straights, it is the only way to keep some of the corners driveable at all.

From the start/finish line, get through the gearbox quickly along Shoreline Drive, essentially a long straight that sweeps slightly to the right. Near the end of Shoreline Drive, along the left hand side in the distance you'll see two grandstands. Just as you pull even with the first grandstand, downshift rapidly to second gear, tap the brakes and take turn number one, a fairly tight right hander. Turn two approaches quickly, a slower first gear left hander. Turn two adjoining turns one and two is very short, so you should drive the first two corner as a combination, much like a chicane.

There's time to briefly get back on the accelerator coming out of the second turn, shifting up to second and braking around turn three. The fourth corner is slightly less demanding and begins a slow ascent of speed toward the second straight. Turn four can easily be taken in second gear, but veteran IndyCar Racing drivers may prefer third. Though braking through his turn is not necessary, it is important to stay off the power until you cleanly exit, in order to setup properly for the next series of bends.

Out of number four, stand on the gas as you take the next two corners, a dogleg left, followed by a slight right hander on to Seaside Way. This segment calls for earlier apexes in order to maintain clearance from the concrete barriers. Remember to keep moving upward through the gearbox here, all the while building top speed.

Careening down Seaside Way, you should be able to steal a quick glance at your instruments while climbing to top speed. Near the end of this strip, you'll see a tall building on the left; use this landmark as your next braking point. Downshift quickly to second and dive into the turn, a roomy right hander. You can carry a little more speed out of this bend and into the next one, a swooping left.

As you exit, set up as wide as possible for the crucial hairpin, a 50 mph, 180 degree right hand kink. Since this turn dumps you back out onto the fastest part of the course, it is hard to tame the urge to get back on the power too soon. The pit entrance comes up fast on the right as you leave the corner, however, and accelerating too quickly out of the hairpin can cause the car to get loose.

When you are safely able to control the car out of the turn again, apply full throttle and head toward the start/finish line. As you round a fast, sweeping right, you'll cross the line and see the pit board display results.

Rush Hours In Michigan.

Coming off of the huge 18 degree bankings, these drivers are poised to rocket down the backstretch at over 230 mph! Pounded by the high g-forces and intense summer heat, IndyCar drivers are pleased to call it a day, five hundred miles later.

Michigan International Speedway

Circuit Type: Super Speedway
Circuit Length: 2 Miles
100% Race Distance: 500 Miles (250 Laps)

Owning the distinction of being the fastest racetrack in North America, Michigan Speedway is the setting for one of the most heart-stopping events on the IndyCar Racing circuit. Often the scene of frequent lead changes, lap speeds at Michigan have been known to exceed **230** mph! The event itself is a grueling 500-miler, with prevailing temperatures at this track usually quite hot, taking an immense toll on machines and drivers alike.

On a super speedway like Michigan, you'll want just about all the speed you can muster. Very little wing downforce is needed to get through the track's four **18** degree high-banked turns. The roadway is very wide, providing a lot of forgiveness to those who stray from the optimum line. Because of the stress imposed on the chassis by the steep corners, take extra care in fine-tuning the cambers and shocks, particularly on the right side of the racecar. The gear box will predominantly serve on purpose, simply to build rpms to a crescendo of top speed.

Since it is deemed too unsafe for IndyCars to race in rainy weather on ovals, the threat of showers at this track will be nonexistent within the simulation. Temperature and wind activity can still have a relevant influence on your racecar's performance, and should be taken into account when devising chassis setups.

As you cross the start/finish marker you will notice that the entire front stretch of the speedway is banked and curves slightly left. This can cause inexperienced IndyCar drivers to make an early apex into turn one, a temptation that should be avoided! Instead, try to keep the car just to the right of center as you approach turn one, diving down low near the apex at the actual start of the corner. By now you should be in top gear, where you'll stay for an entire lap.

Follow a smooth line off of turn one, continuing through turn two. You will feel the centrifugal force pulling your car out near the retaining wall at the turn's exit. If you hear a lot of tire screeching through this segment, plan a trip back to the garage for more tweaking. You'll want a chassis that sticks to the pavement at these breakneck speeds.

Out of number two along the straight backstretch, move back to the right of center so that when you arrive at turn three, you'll be positioned to clip the apex cleanly. The back straight at Michigan is where you'll witness (or be a part of) some of the most frenetic passes in auto racing.

Turns three and four differ in character from one and two. The entrance to turn three comes off of the very straight back stretch, instead of the awkwardly bending front stretch that leads into number one. You can use the same line that got you around the first two corners here, but be careful on the exit of number four. The pit lane entrance comes up fast, and the cars in front are often slowing unpredictably to make a quick stop. The banking and curvature of the pavement creates a natural tendency to want to wind up on the extreme inside at the start/finish line. Because this limits a driver's visibility into turn one, crossing the start/finish stripe near the center of the track is preferred.

Legally Exceeding The Wisconsin Speed Limit.

The straights at Milwaukee always breed excitement. Drivers whip their cars around the track, passing one another with wild abandon. The very idea of squeezing cars three abreast in the turns keeps the crowd ignited with a true passion for IndyCar racing.

The Milwaukee Mile

Circuit Type: Short Oval
Circuit Length: 1 Mile
100% Race Distance: 200 Miles (200 Laps)

Milwaukee is one of the oldest racing venues in North America. Originally constructed for horse racing, IndyCars have been coming to this site now for seven decades. The four turns are each slightly banked at 9 degrees. The symmetry of this track lends itself to a lot of raucous overtaking, occurring on the outside as well as the inside. It is an experience that can be best summed in two words: sheer bedlam!

If the surface is ideal, top speeds will be near 170 mph, with drivers staying on the throttle full throughout each orbit. Lap times will be under 25 seconds, which means you could easily be lapped while in the pits. Picking the right moment for each pitstop is crucial. Short ovals can become quite congested at times, as there seems to be no shortage of traffic. You'll need a chassis setup that delivers excellent grip for control, as well as the necessary speed to run up front.

Since it is deemed too unsafe for IndyCars to race on ovals in rainy weather, the threat of showers at this track will be nonexistent within the simulation. Temperature and wind activity can still have a relevant influence on your racecar's performance, and should be taken into account when devising chassis setups.

As you speed away from the start/finish line, stay near the center of the track in order to gain an unobstructed view of turn one. This corner immediately leads you through turn two, and a smooth line through the pair pays big dividends. Try to drive the nose of your car right along the groove of the track (punctuated by skid marks on the pavement). If you hear any tire screeching through this section of the raceway, you're probably scrubbing off too much speed in the turns. A quick trip back to the garage for some adjustments would be highly recommended.

Coming out of the second turn, you'll see the speedometer begin to climb again. Down the back straight now, drafting and passing opportunities are plentiful. Ease the car back into the center of the track when not engaging traffic. This will set you up on the best line into turn three.

Turns three and four drive almost identical to one and two. Stay in the groove, clip the apex and gently drift back to the outside. Realign your position back to the center of the track down the front straight in order to prepare for turn one.

If you're having trouble finding enough speed on this oval, check your speedometer at each key point of a turn. At the entrance to turns one and three, the car should be at its top speed, about 5 mph over its average speed. Almost immediately as you begin the turn, the speedometer will indicate a gradual loss of speed. This reading shouldn't dip more than 5 mph below your IndyCar's average speed. At the apex, acceleration should begin building again right away. If this sequence isn't methodically occurring on each lap, you're losing too much speed in the corners. Return to the garage for additional tuning. Downforce, camber and shock stiffness are likely culprits that can be tweaked to remedy the problem.

Catch Them If You Can!

The eleventh turn at Monterey brings the field to a crawl just before the main grandstands, treating spectators to a parade of IndyCar machinery.

Laguna Seca Raceway

Circuit Type: Road Course
Circuit Length: 2.214 Miles
100% Race Distance: 185.98 Miles (84 Laps)

A dedicated race facility that has hosted several categories of auto racing action, competition at this track is nothing short of fierce. Sudden elevation changes, high speed corners, hairpins, and the infamous "corkscrew" are all pieces to be solved in the Laguna Seca puzzle. Many of the turns are blind; they see you before you see them! Knowing every inch a racetrack has never been as essential. Before race weekend, expect to log heavy amounts of test mileage in order to grasp a feel for this circuit. Only the best win here, so above all, be patient.

Under normal weather conditions, teams will begin their setup with maximum wing angles in use. Later, as drivers adapt to the complexity of this circuit, cars start becoming a little quicker, indicating a reduction of downforce and drivers growing confidence in their skills. Gear ratios will generally be tight, with little overall range in the engine's power band. At Laguna Seca, it's not how fast you soar down the straights, it's how much speed you can carry through the turns. Make subtle changes to your IndyCar's attributes, and place more emphasis on driving a clean line throughout the circuit.

It goes without saying that under rainy skies, you'll need all the downforce you can put your wings on. Take more top speed out of the car in favor of additional handling. While on the track, recognize the moments that require increased patience, such as following a single file line through the corkscrew.

From the start/finish line, the pavement will crest and bend left through turn one. Stay to the outside (right) as the roadway makes a slight descent; at the base you will see brake markers along the right, indicating a tight left coming up. Turn two is a 180 degree hairpin, causing you to brake hard and stay off of the throttle through the apex. At the exit, stay down the left side as you prepare for turn three.

Number three is a flat turn, but it is surrounded by a grass runoff area that is quick to collect IndyCar drivers who stay on the power too long. If you take the traditional wide racing line through this corner, you can out-accelerate the other drivers to turn four.

The fourth turn is a fast bend to the right that only demands of lift off of the throttle. Hesitate just a couple of beats as you clip its apex, then stand on the gas full to turn five, a fast left. Very little braking is needed to manage the fifth corner, again releasing the accelerator and coasting to the apex.

Speeding toward number six, another fast left, release the throttle as you go under the bridge, and reapply power only when the corner snaps by. Out of six, you'll begin a high speed ascent, bobbing over two rises. At the top of the second grade, turn seven veers right, around a hillside. Using number seven as you prepare to engage the corkscrew (turns 8 and 8A).

Featuring a 25-foot drop, you'll dart left, then immediately right, steadily gaining momentum to the corkscrew's exit. Turn nine, a fast left, can be navigated flat out with a good setup, staying to the outside at its entrance.

Turn ten drives much like turn four: a process of lifting and steering right, letting the car do the work. As you approach the final corner, turn eleven, get on the brakes and slow quickly. Traffic creeps gingerly around this left hairpin, designed to slow the cars to offer a brief glimpse to the race fans perched in the main grandstands.

It's A War In Nazareth, And You're About To Be Drafted.

Despite its designation as a tri-oval, each of Nazareth's turns are unique in character. Overall, IndyCar drivers really enjoy the unconventional track layout. Not only does it provide the racing public with a terrific venue, but the teams find Nazareth's challenges to be quite stimulating.

Nazareth Speedway

Circuit Type: Tri-Oval
Circuit Length: 1 Mile
100% Race Distance: 200 Miles (200 Laps)

Nazareth is clearly one of the most uniquely shaped ovals found on the IndyCar circuit. Though on paper it is referred to as a tri-oval, some drivers treat Nazareth as though it has four or even five distinct turns. By any account, at Nazareth you'll spend a lot of time turning, since the three corners are less than a third of a mile apart along the front stretch. The back straight takes on additional importance for building speed into the long series of turns. Bankings vary between four and ten degrees, with turn three's narrow radius sporting the highest bank.

Picture-perfect racing weather means that each team will be looking for plenty of top speed. Very little downforce will be needed, but the suspension should be stiffened to ward off excessive chassis roll and camber changes imposed by the inconsistent banking and corners. Take a good look at the brake bias settings here- you'll want to make sure that turn three doesn't scrub off too much of your well-earned speed.

Since it is deemed too unsafe for IndyCars to race on ovals in rainy weather, the threat of showers at this track will be nonexistent within the simulation. Temperature and wind activity can still have a relevant influence on your racecar's performance, and should be taken into account when devising chassis setups.

From the start/finish line, you'll enter turn one, a slight left hander that can be taken flat out. You will notice that a lack of concentration at this track could result in your car leaving the optimum path in a split second. This can be attributed to the gradual variances in the pavement's banking (camber), as well as the different radiuses employed at each corner.

You should still be building speed as you dive left into turn two, the longest corner on the track. This turn feels very much like the combination of turns one and two at New England, and can be driven in like manner. You may find that clipping two apexes here gets you through this section a tad bit faster than taking the traditional single line approach.

Along the back straight (which is shorter than you think), you may have a good opportunity to toggle your black box mode and glance at the console, or it may be prime time for a drafting maneuver.

Turn three is by far the most demanding on the circuit. The tight left bend may require you to lift off of the throttle and coast to the apex in top gear before getting back on the power to blast across the start/finish line. Aside from this brief lapse in acceleration you should be able to orbit the remainder of the track while applying full power.

Note that the pit exit dumps the cars out near the back straight. The long wrap-around pit road will not only take some getting used to, but it will challenge your ability to be patient as well. Some of the cars will be lapping this track in under 20 seconds, so carefully pick you moments to head for your pit to avoid being passed while you're waiting for a refuel.

Life In The Fast Lane.

The groove at New England is well-defined for speed. Though most drivers prefer the optimum line, short ovals like this one tend to keep the traffic heavy, forcing unorthodox maneuvers. Battles are waged on almost every line of the race track, as spectators are fed a steady diet of wheel-to-wheel racing.

New Hampshire International Speedway

Circuit Type: Short Oval
Circuit Length: 1.058 Miles
100% Race Distance: 211.6 Miles (200 Laps)

Located in New Hampshire, this raceway is one of the newer facilities to host an IndyCar event. Providing a backdrop for an exciting, shoot 'em up brand of racing, the short oval differs from the one found at Milwaukee in many ways. First, New England's turns are banked at a lofty 12 degrees, compared to Milwaukee's 9 degree corners. Second, New England's oval consumes less acreage, with each corner being a little tighter than those found at Milwaukee.

Under sunny skies that track can be challenging. Pressures mounts on each team to find additional speed, as the racecars struggle to hold grip through the corners. You'll probably discover the need for more downforce than you used at Milwaukee, so you may have to manufacture top speed from other areas. The track surface itself is wide, with drafting and passing happening just about anywhere. Cars are routinely lapping the circuit in well under 25 seconds, so getting in and out of the pit lane in expeditious fashion is a must.

Since it is deemed too unsafe for IndyCars to race in rainy weather on ovals, the threat of showers at this track will be nonexistent within the simulation. Temperature and wind activity can still have a relevant influence on your racecar's performance, and should be taken into account when devising chassis setups.

Speeding away from the start/finish line, the entrance to turns one and two is quite spacious. Though hitting the groove of the track is ideal, there is a measure of forgiveness for driving errors, as well as for those wishing to deviate from this line in order to past back markers. Try to establish one fluid line through one and two, while staying on the power full.

Out of turn two now, the wide back straight opens the door for many possibilities. Cars are often three abreast here, and drivers are forced to make quick, reactive decisions as they jockey for position. Any IndyCar driver's main objective for this straight should be to produce a clean line so as to obtain top speed into turn three.

At three and four, duck back down across the apex (following the groove) and drive both turns together as on single corner. The exit at turn four is similar to the one found at turn two, with the exception of the added pit entrance. Good heads-up driving should keep you away from tangling with opponents wishing to pit.

Many drivers demand too much from their car and team at tracks like New England. Remember, you don't have to grab the lead on the first lap, and hold it throughout the race. As long as you're the front-runner on the final lap, you'll collect the win, IndyCar Racing championship points, and well-earned respect from your foes. Therefore, find a car setup that allows you to stay on the lead lap and drive the corners without a lot of noisy tire screeching.

Blazing An Oregon Trail.

Though parts of this dedicated road course are twisty and challenging, Portland has all the necessary ingredients for a world class IndyCar event. Long, fast straights, lots of runoff area and flat topography keep the speeds up and the thrills flowing.

Portland International Raceway

Circuit Type: Road Course
Circuit Length: 1.95 Miles
100% Race Distance: 198.9 Miles (102 Laps)

Set amidst typical Pacific Northwestern scenery, the track at Portland is the site of a rousing IndyCar race. The two long straights give the general race fans plenty of excitement, while pursuits enjoy watching the drivers contend with a variety of turn radiuses. The "lie of the land" is fairly flat and the competition close, leaving most races in doubt until the end.

If dry weather prevails, teams will be looking for a substantial amount of top speed, with some consideration going toward the issue of acceleration. This will leave the drivers to rely on their own inherent skills to get the car through the corners. Many of the turns here are combined alongside one another, so it's a good idea to rid your chassis of any oversteer, by adding some rear wing and perhaps softening the rear suspension.

In wet weather, you'll find the need for more wing on the car, but don't overdo it! Remember, the two long straights are essential to churning out fast laps, so you've still got to be able to build tip speed on them. You'll need to make more corrections for rain by altering your driving style, braking earlier for the corners, maybe even dropping an extra gear as you make your turns.

As you leave the start/finish line, build speed to a full throttle as quickly as possible. Keep a close eye on the brake markers that will appear on the left side. Your vault down the straightaway will be abruptly ended by the chicane, a very tight right-left-right jog. As you clear the apex of the chicane's last right hander, get back on the accelerator and rush down the short straight leading to the first series of turns.

Turns 1, 1a and 2 should be driven as a right had combination, though each will require different speeds. With a good setup, turn one can usually be taken just by letting off of the throttle, coasting through turn 1a in the same manner. The bend tightens as you wind through number two.

Out of the second turn, accelerate down the short straight that introduces the third corner. Turns three and four team up together to build a long, medium-speed, sweeping left that culminates at the entrance to turn five, a tight right.

After slowing for five, turns 5a and six are relatively easy and can be taken flat out. This is one of the faster segments on the course, providing opportunities to draft, pass or regain valuable lost time.

Stay on the power until you see the brake markers on the right, indicating turn seven coming up. Turns seven, eight and nine form another combination that when driven properly, lead to faster laps. Seven is a shallow left, followed shortly by eight, a medium right. The ninth corner brings the field's velocity way down, before relaunching the drivers down the front straight. Note that the mouth of the pit lane's exit is located just before the chicane. Don't overcook it as you leave the pits, or you'll end up in the barrier wall!

Single File, IndyCar Style.

Though touted as a fast road circuit, some of Toronto's eleven turns are so sharp that only one car at a time can fit through. Corners like these not only demand pinpoint accuracy and patience, but also the ability to correctly anticipate the oppositions' line.

Exhibition Place, Toronto

Circuit Type: Temporary Street
Circuit Length: 1.780 Miles
100% Race Distance: 183 Miles (103 Laps)

Regarded as one of the IndyCar drivers' favorite circuits, Toronto is a fast, wide racetrack that naturally lends itself to some interesting cat-and-mouse chases. Though by no means an easy course to master (it does have 11 turns), it can be a quite satisfying venue to race on, once grasped. The scenic raceway winds through the exhibition fairgrounds, using a variety of straights, fast corners and hairpins.

Given pristine weather, turns 1, 3, 5, 8 and 9 present quite a challenge. These are all slow corners that utilize the bottom half of the gearbox. Almost every other section of the track is fast. It may take many miles of testing to discover the best compilation of tunings for this circuit. Because of the variance in skill and style among drivers, each team's approach to the Toronto circuit may be unique. Overall, you'll want enough downforce to drive the tight corners under full control, yet you'll need plenty of top speed for the long section between turns one and three. Don't overlook the importance of the brake bias adjustment here. In addition, pay careful scrutiny to your tire setups to ensure that each wheel is offering worthy grip.

Wet weather changes the entire complexion of the raceway. Teams add large amounts of downforce to cope with the arduous corners, sacrificing top speed on the faster sectors. Though the track surface is completely flat, rain does tend to elevate the difficulty level of braking into the corners, demanding the utmost in heads-up temperament.

Streaking away from the start/finish line, you won't step very far up the gearbox before encountering turn one, a tight right hander. This is one of the key corners on the track, because it leads into a long, fast ride through the exhibition field. Try to drive as clean a line as possible, scrubbing off very little speed while getting back on the power quickly at the apex.

Turn two is a fast bend to the right just out of turn one. You can drive right through it with full throttle. Build all the speed you can, flying down a lengthy straight alongside the baseball stadium.

As you approach the second pedestrian bridge, you'll see the brake markers on the left side into turn three. This turn is very tricky; it drives like a gradually tightening corner. You'll have to downshift to the bottom quickly, and run a wide line about halfway through the bend. Accelerate back up at the apex, whip through turn four (a fast left) and head for five.

Turn five is a slow left corner that can't be held if you enter it too fast. Once you begin exiting the turn, number six lies just ahead. A lazy right bend, lift off the throttle and stay to the outside as you drift around its apex.

Safely out of six, put your foot back down and attach turn seven, a slight veer to the right that leads to eight. Brake markers just ahead of number eight indicate the severity of the corner. Virtually a 90 degree right, don't be too eager to accelerate out of this turn. Number nine is equally threatening, a slow left hander at the stadium.

Taking the best line, turns ten (a fast right) and eleven (a fast left) can be had at high speed. At most, the pair may demand a quick lift off of the accelerator as they are rounded. The start/finish line located just at the exit of turn eleven, with the pit entrance opening up just before the tenth corner.

IndyCar Driving Tips

Driver's Handbook Of Hints

It takes a lot of preparation to win consistently on the IndyCar circuit. By now you probably realize that IndyCar victories do not necessarily belong to the fastest driver. The drivers that best adapt their cars and driving styles to fit each brand of track generally make up racing's elite. With determination, grit and a little racing luck, you may find yourself in this category someday. Since Papyrus is dedicated to churning out winning drivers, we would like to offer you several helpful tips to enhance your driving skills.

Basic Cornering Techniques

Any turn on a racetrack can be broken down into three distinct areas: the entry point, the apex, and the exit. The correct entry point is the position on the track that provides the best angle of attach into the oncoming turn. The apex is the slowest part of that turn. It is generally the closet point inside the turn that you will want your car to be. The exit is defined as the point in the turn at which you being to accelerate once again. This immediately follows the apex. In IndyCar Racing, these three areas (also called the "groove") are clearly defined by skid marks along the pavement.

Speedway Essentials

There are two basic types of speedways on the IndyCar circuit: super speedways (2 miles or longer) and short ovals (under 2 miles). Flinging your car down the straights in fifth or sixth gear is the easy part; keeping the accelerator on the floor in the turns is an entirely different matter.

On super speedways, you must learn to attack each turn individually. Try to position your car just to the right of center on the long straights. As you approach a corner, steer down low into the turn, hanging your left wheels on or just below the safely line. The apex of most speedway corners is located dead center along the inside of the turn. As your wheels cross the apex, the car should begin drifting outward under centrifugal force. You'll only want to apply enough left steering to keep the car away from the outer wall. With a proper chassis setup and solid cornering skills you should be able to drive through these super speedway turns without letting up (unless traffic forces you to).

Short ovals require a slightly different approach. Because overall speeds are lower and traffic tends to be a little thicker, concerning on short ovals can be far more challenging. Instead of visualizing each turn separately, you'll need to consider them in pairs. Turns one and two will need to be driven as one double-apex corner, for example. You will find that it's quite difficult to drive a smooth turn two if your turn one was sloppy. Find a compilation of chassis settings that allow you to drive the short oval corners flat out. You'll have a tough time using the same chassis tunings at New England as you did at Michigan.

Street & Road Course Strategy

Road courses offer the most challenging, yet pure driving experiences found in an IndyCar. Each circuit features its own unique characteristics, and every facet of them becomes the subject of intense study by the top drivers.

Since each turn varies somewhat, it is absolutely necessary to memorize the appropriate gears to be in at each corner. In practice sessions, look for brake markers and landmarks to help you learn when to brake and downshift into each corner of a road circuit. Watch the other drivers in practice to help determine the amount of speed you'll need to carry through the turns. Be prepared to make changes to the car's gear ratios and downforce settings to stay competitive. Theoretically, your chassis tunings should allow you to drive each corner in the groove of the track (designated by skid marks) at speeds comparable to that of your opponents.

Be advised that certain corners are so tight that they can only generally accommodate single file traffic. Turn number nine at Long Beach offers a prime example. Very few drivers will safely overtake anyone in this corner. It is far wiser to patiently wade through the turn along with the traffic, then try to out-accelerate your opposition to the start/finish line on Shoreline Drive.

Pit lane entrance and exit layouts are inconsistent among the road courses. You should spend some practice time driving into and through the pit area to get a glimpse at your crew's assigned position, as well as the configuration of the pit entrance way. Often overlooked, it is also vital to check out the pit exit. Make a mental note of any oncoming hazard as you leave the pits, such as a sharp turn or congested area.

Qualifying Tactics

IndyCar teams formulate several possible car setups for raceday, in order to deal with the changing elements and issues. Qualification setups are also closely scrutinized as teams try to crack the starting field with every ounce of speed they can drain from the car. Actual qualifying formats change according to the type of race being run. Road and street circuits utilize a timed qualification session, in which each driver participates simultaneously. Each lap you complete is clocked, with your quickest time determining your place on the starting gird. Since traffic can pose a major obstacle toward obtaining an acceptable fast lap time, it is recommended that you wait for a large gap between opponents, so you'll have a clear shot at the pole. Speedway qualifying consists of each driver running two laps alone on the track. The faster of the two laps is used to place each driver in a starting spot. The Indianapolis Motor Speedway qualifying consists of each driver running two laps alone on the track. Instead of the best of two, each driver is required to complete four consecutive laps, alone on the track. These four laps are then averaged together to assign each driver a starting position.

Whatever the format, take only the fuel needed to fulfill the qualifying requirements. A full tank will only weigh your IndyCar down unnecessarily. You'll also want soft tire compounds to improve grip, and perhaps lower wings to help carry you down the straights faster. Overall, try not to change the car too drastically from your racing setup, as it's important to establish a consistent feel for each track. Make only the alterations needed to have a few ticks off your lap times, and remember to return to the garage when you have finished qualifying. Your pit crew will want a final opportunity to refuel and prep the car before the green flap drops!

Passing- Offense And Defense

When overtaking the other cars, it is generally better to pass on the inside. This may even mean dropping down onto the aprons to pass during speedway turns. If you pass on the outside, you will not have an adequate view of the track and approaching turns. Taking a wide, outside line to try to pass an opponent also places your car in an unpredictable zone. Your IndyCar was probably setup to perform best in the groove of the track, and may not be able to maintain tire adhesion when forced to the outside.

Efficient Technique: Drop down below your opponent and take command of the inside line. The shot on the left provides an in-cockpit view of the safest passing line. On the right, an external view reveals how much room there really is down low!

Should you find a slightly faster car nipping at your spoiler, you can fend off the assault by watching your rear view mirrors and matching your rival's movements. for instance, if your opponent tries to slip by on your right, you can dart right to block and hold your position. this may force the challenger to brake and drop back momentarily. Your goal should be to buy just enough time to reach slower traffic, where you may be able to increase the interval between your car and your opposition. Don't get so focused on the rear views that you forget to watch the road ahead, however!

Many drivers will attest that the two most dangerous places to pass on any track are at the pit entrance and exit. At the pit lane entrance, back markers (slower cars) may suddenly move down along the inside to execute a pitstop. You've got to be on your toes in order to ensure that you don't get tangled up while trying to occupy the same line. At the exit, other cars may be entering the track in your blind spot, upon completing a successful pitstop. Be prepared for the unexpected! Stay wide of any pit exit if possible, and exercise patience when overtaking other drivers near the pit areas.

Above all else, remember: you don't have to assume the lead of a race form the opening lap. The final lap is the only one that counts in the standings, so take your time and try to reel your opponents in, one-by-one. Each race presents its share of misfortune to the unlucky, from dreadful crashes to frustrating mechanical breakdowns. The driver you have been chasing for over 150 miles may suddenly experience one of these fates, leaving the door open for your charge to the forefront of IndyCar glory.

Tuning Your IndyCar

The Four Forces Of Racing

Before you begin serious tweaking on you IndyCar, it is important to understand four basic forces that act on you car's handling. In order to tune a winning racecar, you must strive for a balance between these dynamics:

1.) Downforce. Generally a product of the aerodynamic capabilities of the racecar, Indy teams spend a lot of time and money on the science of selecting the right wing settings for a given track and conditions. The wings on your IndyCar are designed to create a downward flow of air, literally pressing your car down onto the track. This makes your car handle much faster through the turns, but slow your top speed somewhat on the straights. You can add more downforce to improve overall handling by increasing the front and rear wing angles in the pits. Conversely, you can reduce downforce to gain top speed by lowering the wings angles on your car. Indy teams outfit their racecars with slim, flat wings for speedways, and boxy, larger wings capable of creating more downforce for road courses. In addition to the wings, total fuel and driver weight produces subtle changes in your racecar's downforce values.

2.) Tire Contact Patch Forces. This is most simply defined as the part of the tire that is actually touching the pavement at a given moment. This contact patch on each tire changes size and shape during driving, depending upon the car's suspension setups combined with the demands of the race circuit. One of your primary goals should be to keep as much of each tire's surface touching the road as possible.

The bigger the contact patch, the better the tire's grip. Better grip means better traction, which means your car's engine can work most efficiently. You'll want to try to create the largest contact patch possible on each wheel, producing even tire wear and plenty of gripping power.

3.) Engine Torque. IndyCars have six-speed transmissions. By interchanging different sized gear cogs, the technical team can derive various results from the car's powerplant.

For example, a twisty street circuit like Long Beach may demand "tight" gearing, that is higher rpms in each gear with less top speed. This will allow the driver to have more horsepower on demand in the corners where it will be needed. However, on a speedway oval like Michigan, the team will probably opt for "longer" gearing to present the driver more flat-out speed for the long straights, since all corners will most likely be taken in top gear.

4.) Drag. This term describes the amount of wind resistance working against the car in given conditions. As the racecar approaches high speeds, the front of the car punching through the air mass creates turbulence. This airflow passes from the nose of the car to the tail, some of it being deflected by the wings to produce downforce. The more surface area on the car that is available to this air, the more drag that is generated as this air strikes it.

On speedways, minimal drag is desired, to obtain solid top speeds. On road courses, car control is everything, therefore drag loads upon the race car will be heavier, due to the team's use of larger road course wings, adjusted at steeper angles.

A Quick Look Under The Car

Looking up at the chassis from beneath the road, you'd get a tremendous glimpse at the racecar's "footprints." In a static position, each tire creates a footprint, better known in racing terms as a "contact patch." The size and shape of each wheel's contact patch will change continuously as the car is driven. It is not only the responsibility of the driver to be aware of this information, but the entire race team's as well.

The treaded areas represent each tire's contact patch. You'll notice that the rear tires offer larger contact patches than the fronts, because the rear tires themselves are larger. Your IndyCar's engine is located at the rear of the chassis, and directly propels the rear wheels.

By utilizing bigger tires in the rear, the competitive IndyCar team can make better use of this engine power during acceleration modes. The larger contact patches provide the car with more grip and traction under acceleration.

Until the mid-1960's, IndyCars were built with engines located in the front of the car. The drive-shaft from the engine ran through the cockpit right next to the driver's seat! It was quite common to mount four identical tires on these cars, to offset the weight of the engine in the nose of the car.

The following pages will explain how weight distribution in the chassis affects the size of each contact patch as the car is driven, and is of paramount importance to chalking up fast lap times.

As The Driver Accelerates

From the static position, the driver applies the accelerator. As this occurs, the weight of the car begins to shift from the front to the rear. This is known as "load transfer." As this begins to take place, the driver's own body weight is shifted rearward with the car. The weight of the front of the racecar actually lightens, while the load upon the rear of the car increases. The reduction of weight at the front of the car naturally creates smaller contact patches on the front tires, while the addition of weight at the rear of the racecar presses the back tires more firmly to the track surface, enlarging their contact patches. Remember that the rear tires are larger to begin with, and the combination of shifted weight to the back of the car produces excellent gripping power, supplied directly to the very wheels that propel the car.

Because the front wheels have a smaller contact patch under acceleration, they offer less grip or traction to the IndyCar. This may appear to be of little consequence, since they are not under any direct power form the car's engine. However, certain corners on some of the tracks can be negotiated at full speed. Because the contact patches up front are smaller, the car may tend to "understeer," or push toward the outside of the turn.

Your goal in setting up the IndyCar's suspension will be to obtain good grip at acceleration, while balancing it with cornering and braking traction. The fastest lap times generally belong to the teams that find the most equality in these concerns, not to the team with the biggest engine!*As the driver accelerates, weight is transferred toward the rear of the racecars.*

As The Driver Applies Brakes

Imagine yourself rocketing down the backstretch at Indianapolis, eclipsing speeds of over 230 mph. Without warning, your low-fuel indicator light begins to blink, signaling a return to the friendly confines of your race team in your pit. As you enter the pit straight, you're still keeping your speed close to 100 mph in an attempt to keep hold on any time advantage to gain. Closing in on your designated pit area now, you get on the brakes firmly, coming to a complete standstill for your awaiting crew.

As you brake, the weight of your car now begins to shift forward. Because weight is transferred to the front of the car, the front tires are pressed to the track with more force. This causes the contact patches on the front tires to enlarge in size, providing more grip at the nose of the car. Consequently, the decrease in weight at the rear of the car means that the rear tires will offer less grip than the front under heavy braking, because the rear contact patches become smaller.

This rear-to-front transfer of weight accounts for two obvious results of braking:

First, the nose of your car bears downward under braking, then gently arises to a static position at full stop.

Second, front brake pads experience a shorter lifespan than rear one do. With considerably more weight shifted to the front of the car, the front brakes must work much harder to execute a complete stop. This imbalance can be compensated for by adjusting the racecar's brake bias*As the car is braked to a stop, weight is shifted forward, as indicated by the arrows.*

As The Driver Negotiates A Turn

Under acceleration, bear in mind that more weight will be transferred to the rear of the car. When the driver begins to enter a turn, the brakes are applied, causing weight transfer to shift forward. This momentarily enlarges the front tire contact patches.

As the steering wheel is manipulated for the turn, the car's weight begins to transfer to the outside of the turn. The outside wheels begin to develop larger contact patches than the inside.

Depending upon the degree of difficulty the turn presents, weight transfer may continue to the outside, stressing the outside tires. The inside tires begin to perform less work as weight is shifted away from them. Have you ever watched a test driver weave back and forth through stationary pylons at a high rate of speed? If so, you'd notice that the entire car body shifts back and forth, always tilting toward the outside of the turn. This is result of weight transfer.

The amount of weight transfer that your car experiences has a significant effect on how fast it can be driven through turns, and what kind of acceleration/braking is available to the drive on demand.

It is also important to note that weight transfer can be acted upon the topography of the track. For instance, as your IndyCar climbs up a steep hill, not only does it experience more weight transfer at the rear due to acceleration, but also because of gravity. More of the car's weight is naturally shifted downhill. This means the contact patches generated by your rear tires would be greatly exaggerated, while your front wheels are providing minimal gap.

Initially, the driver will apply the brakes in order to slow down for the turn, causing a brief weight shift forward. As the car is driven through the turn, weight begins to shift to the outside of the turn. Note the effect load transfer has on the contact patches as the driver executes the turn.

Definition: Understeer

There you are at Long Beach, rocketing down Shoreline Drive in your IndyCar. As you brake hard into the tight right-hander at the end of the straight, you can hear the squeal of rubber as your tires try to find adhesion. The nose of your car aims outward, as if the car can't quite make the turn. What you have just experienced is called "understeer."

The term "understeer" means that your front tires have lost their grip on the pavement. When this happens, the car wants to travel straight ahead instead of in the direction you are steering. Most IndyCar teams begin their chassis tuning process with some understeer tweaked into the suspension. Gradually, as the driver becomes more comfortable with the car and race track, some or all of the understeer is removed. This is performed by adding front wing, softening the front suspension, and /or stiffening the rear to the desired level.

In addition to performing alterations to your chassis setup, you can correct a severe understeering condition as it occurs, by backing off of the accelerator and possibly adding a soft touch of the break pedal. This procedure will cause weight to transfer forward, giving the front tires "bite" on the roadway. An understeering IndyCar is said to be "pushing."

Understeer: Can be corrected in the car by braking, or in the garage by adding front wing and softening front end.

Definition: Oversteer

There you are, approaching that same corner at Long Beach again, but this time with a different chassis setup. As you downshift and brake into the turn you are once again greeted with the sound of skidding. the rear of the car swings outward, perhaps violently, as you flail helplessly across the tarmac. Settling against (or maybe into) the retaining wall, you notice the other drivers swerving around your car, shaking their fists at you in utter disdain.

"Oversteer" means that your IndyCar's rear tires have lost their grip on the pavement, causing the back end of the car to "fishtail" to the outside. An oversteering IndyCar is said to be "loose," and presents a dangerous hazard to the driver, other competitors and spectators. The oversteering chassis can be corrected by adding rear wing, stiffening the front end, and perhaps softening the rear suspension.

Should you find yourself in the middle of a skid caused by an oversteering condition, you'll need to apply a different method of corrective action than an understeer would require. Braking would cause the forward transference of weight, only adding to the existing problem. Instead, you must steer sharply in the direction of the skid (opposite of the corner's direction) and "feather" the throttle through the turn.

Classic oversteer: To correct it, get more downforce by adding rear wing, and softening the rear suspension.

Weather: The Great Equalizer

From the Options screen found on the Main menu, you can access the Realism menu. By selecting Weather from this menu, you can make decisions concerning the trackside climate found during your driving sessions. Choices range from constant weather selected by the user, to random weather selected by the computer.

Rain causes a loss of tire grip, generally compelling you to add downforce and mount rain tires on you IndyCar. Should the forecast call for rain, you'll need to make full use of any practice sessions available in order to devise a workable car setup. Note that races will not be held in the rain on short ovals, tire-ovals or speedways. The wet weather combined with the high speeds typical of such tracks creates an environment that is simply too unsafe for any sane IndyCar driver.

Wind variations can affect overall lap times. Driving into a headwind slows the car down, while getting a push from a tailwind speeds the car up. Wind readings may also affect your ability to draft the competition. Into a headwind, you can realize a greater benefit via drafting, because the opponent in front of you will be sustaining assaults from the gusty weather while you enjoy the tow.

The Temperature at the track has its most significant affect on the wings. Hotter air becomes less dense, and therefore provides less downforce to the wings. Hot weather also brings the tires up to operating temperature more quickly, and may cause them to overheat, thus shortening tire life and reducing grip. Cooler temperatures add up to a cooler track surface, and cooler tires. Grip may not be optimum, but tire life will extended.

Note: The weather report shown when a track is selected will remain identical throughout all session in the race weekend. For example, the weather you experience in the practice round will match the weather you experience during the race itself.

The Garage Menu

During preseason testing, practice or qualifying sessions, you may choose to roll you car into the privacy of the team's garage for major adjustments. Although it is not necessary to make minor adjustments from inside the garage (tires, wings, etc. can all be handled by your pit crew if you wish), they are available to you here as well.

Fuel: Choose this option to have your fuel cell filled with methanol. You can top off the tank or "splash and go."
Tires: Allows you to change tires, select compounds, adjust tire pressures and determine stagger.
Wings: Make adjustments to your wing angles, both front and rear with this selection.
Suspension: This is where you'll go for camber and shock changes. These adjustments are not available during a race.
Gearbox: Tune your engine rpms, setting each gear individually. Not available during a race.
Settings: Save or recall your best car setups to use again and again, from any tack.
Done: Choose this to leave the garage.

Fuel: Supply And Demand

Your IndyCar burns methanol fuel, not gasoline. Methanol is refined methyl alcohol, more commonly known as the simplest of alcohols, "wood alcohol."

Methanol is the IndyCar fuel of choice for several reasons, chief among them being efficiency. It is slower burning than gas, and conversely produces almost no pollution. At the same time, methanol provides a higher octane fuel to the pistons of your engine. IndyCar engines are specifically designed to deal with its corrosive effects-seals, plugs and camshaft timing are just a few of the areas specially designed to withstand methanol fuel consumption.

Aside from efficiency, methanol fuel is safer. It burns cleanly, producing virtually no smoke. This trait keeps other driver's vision from becoming impaired by smoke in the event you suffer a blown engine or have an accident. Methanol's "flash pint" is also very high, meaning it's less likely to ignite if spilled on a hot engine, and if it does ignite, the fire can be extinguished with water. Methanol's lone drawback in this area is that its flames are generally invisible. Occasionally, following an accident, driver may become literally engulfed in flames, completely unbeknownst to the safety crews that converge on the scene. Ironically, the paramedics may find themselves in jeopardy as they quickly move to save lives.

Fuel is stored in a crash-worthy tank located directly behind the driver. A fuel cell made of materials similar to that found in bullet-proof vests houses the fuel inside the tank, helping to ensure that the methanol stays there in the event of an accident. Each fuel line protruding from the tank assembly has a mechanical shut off system installed to immediately terminate fuel flow if a crash occurs*Fuel is stored directly behind the driver, in a special fuel cell designated to withstand the severest of impacts.*

In the interest of safety, IndyCars are restricted by the rules to a 40-gallon fuel capacity. Total fuel payload weight of your IndyCar is 240-270 lbs. You'll notice that this substantial figure means your car will handle quite differently on an empty tank than it will immediately after being topped off. On road courses, your racecar may feel sluggish and unresponsive through curves and chicanes in the early going, or upon exiting the pits with a freshly filled tank.

On speedways, the car may "push" to the outside in corners, forcing you to let up on the accelerator briefly to compensate. This can become quite unnerving for some drivers, but you can buffer this effect somewhat by adjusting your front and rear anti-roll bars from inside the cockpit as you drive. As your fuel is gradually expended, you'll notice the car becomes much quicker, the additional speed perhaps making it somewhat erratic to drive. You can again combat this occurrence by readjusting your anti-roll bars, taking some of the "play" out of the car's handling.

Where The Rubber Meets The Road

Tire Compounds: Due to safety regulations, IndyCar tires are wider and harder than Formula One tires. They are treadless (slick), tubeless tires mounted on magnesium wheels. As both the owner and driver, you are required to choose a rubber compound you'd like mounted on each wheel of the racecar. Softer compounds provide better grip because they reach optimum temperature faster, and absorb more heat throughout the tire. This improved traction comes with a heavy price however; softer tires are more prone to overheat, becoming "spongy" and eventually coming apart. Harder rubber composites generally provide less grip overall, but last considerably longer as they are able to endure more stress. Since you'll want to pit for tire changes as little as possible, you must weigh carefully your decision concerning each wheel of the car. Are the gains made in lap speeds going to be worth additional pit stops for tires? It's your call!

Road Course Tire Selections

Road courses demand an entirely differently strategy and driving style from that of super-speedways. The nature of the track's layout and surface will dictate what compounds you opt for. Typically, handling becomes paramount over pure speed, and generally your tire set will be comprised of identical compounds on each wheel.

Speedway Tire Selections

Speedways require an entirely different set of goals from your IndyCar team. Speed is the primary issue. Since all of the turns on the track are in the same direction, your tire set may contain four completely different tires. For instance, a track like Michigan International Speedway has only left turns; this means your right front tire will be handling the most stress, so you may want a hard compound on that wheel. Conversely, your left front tire will bear the easiest load, and you may find a soft compound will last for sixty laps!

Tire compounds can be changed at any time by selecting "tires" from either the garage or pit menu. The thermometer shows you the current temperatures across each tire individually. (The "I" is inner, "M" is middle and "O" is outer, referring to the various locations on the tire surface that temps are read from.)

Below, you will see a list that depicts proper temperature ranges for each grade of rubber. During test sessions, be sure to check the overall time temperature of each wheel, and correct any selections which may be overheating by choosing a harder compound.

Optimum Tire Temperatures:

Soft **-** *240 degrees, Medium* **-** *250 degrees, Hard* **-** *260 degrees, Rain* **-** *220 degrees, Threshold* **-** *300 degrees.*

Tire Temperatures: Note that 300 degrees Fahrenheit is maximum operating temperatures, as per factory specs. Keeping overall tire temperatures lower achieves maximum life and performance of their rubber compounds, while running the tires hotter can offer better overall grip at a price of longevity. The circled cutaway in the tires menu shows you an image of the current integrity of the tire to help you estimate remaining tire life. *(see next page)*

Inclement Weather

In case of adverse weather conditions, rain tires may be employed. Also called "wets," rain tires are utilized in road course competitions held under showery skies. These tires offer maximum tread in order to channel as much water away from the wheels as possible. We strongly recommend these tires be mounted on your racecar should the threat of rain become obvious. Your continued good health and successful IndyCar career mean alot to us here at Papyrus Racing.

Reading Tread-Depth Indicator

Each tire mounted on your IndyCar has two depressions on the surface. These are the tread-depth indicators. Keep an eye on these for clues as to the tire's current state and remaining life.

Fresh Rubber. When your crew has just installed new tires, the indicators are very deep and easy to read. (Indicators pointed out with arrow.)

Partially worn. After they've got some miles on them, they begin to look like this. Note the excessive temperatures readings from this tire-time to return?

Ready For The Dump. The indicators get awfully low as precious rubber gets scrubbed off, eventually leading to a blowout if neglected

Tires: Contents Under Pressure

Consider for a moment some of the closest finishes in IndyCar history, races that were won or lost by less than a second. in so doing, you wouldn't ordinarily think that a little thing like tire pressures could have decided the final outcome in these races, but it just might have!

The tires on your IndyCar are not filled with compressed air; they contain nitrogen gas instead. Nitrogen is the most abundant uncombined element in the world. Air is 78.06% nitrogen gas by volume, but air itself is very inconsistent inside a racing tire. The humidity levels and overall qualities found in compressed air are difficult to confirm. Therefore, as an air-filled tire heats up, the air content inside expands unpredictably, causing the pressure in the tire to rise at random. Nitrogen gas, on the other hand, costs about the same as compressed air, and is relatively inert (inactive). Therefore, it delivers much more accurate readings whether cold or hot. The tire pressure changes will be much easier for your team to anticipate.

Nitrogen gas is not explosive and presents no danger to those working on your pit crew.

In testing, IndyCar teams constantly monitor tire pressure on each wheel, in order to learn as much as possible about tire wear and compound selections. Used tires that are stripped off the racecar in the pits are carefully "read" by team members and representatives from the tire maker. This gives the IndyCar team a vision for what setups to utilize on raceday, while providing the manufacturer with valuable information that can lead to future improvements in performance and safety.

On raceday, tire pressures are preset by the crew to specific levels. In the race itself, there is not time to perform a pressure check during a tire change, this must be done in advance. As the temperatures on the track and in the air change, the pressure in each tire may change slightly as well. In addition, the crew may elect to change pressures throughout the race, on tires that have not yet been installed. This might occur in order to improve the car's handling, or to keep in step with the atmospheric changes taking place at the track.

Driving style will also likely affect pressure choices. More aggressive drivers may need to combat excessive tire punishment on certain wheels with over-inflation. More restrained drivers may find, however, that they finish the race with "too much tire." Perhaps softening tires with lower pressures and choosing more pliable compounds will award favorable results to conservative driver. As a general rule of thumb, it is vital that you strive for identical temperature reading all across the tire. This generally ensures the longest possible tire life, while minimizing the number of pit stops you'll need to make.

During test sessions, warm your car up with a few complete laps. Cold tires cannot be accurately gauged because the pressures may rise a little as your tires heat up. Starting with the left front wheel, check the temperatures on the tire. If the center temperature is warmer than the two outside, you'll want to deflate the tire some. If temperatures on the outside edges are significantly hotter than the middle, you'll need to increase pressures until they even out.

Just as in actual IndyCar racing, it's perfectly normal to drive a few "hot laps," make necessary modifications, then drive a few more to check out the results. Actual race teams spend countless hours in testing and practice sessions addressing these very same concerns, searching for that perfect combination of setups in order to obtain a few hundredths of seconds of additional speed per lap!

It is vital to note that as your IndyCar's tire pressures change, so do the tire "profiles." In other words, an underinflated tire will tend to sag in the middle of the tread surface, while an overinflated tire will protrude in this area. by altering the pressure of a given tire, the rolling drag of that tire is also changed. This means that an underinflated tire will tend to be more flexible, provide better grip and increase that tire's total temperature-all at a price of reduced speed because of the additional rolling drag.

If you just can't get a tire warm enough to operate properly, you might try relieving the tire of some pressure. This will cause the tire to increase in temperature, supplying better grip, though the temperature differences across the tire may rob it of some life. Conversely, if a tire is getting a bit too hot, you could try raising the pressure some to cool it down.

Stagger: A Game Of Inches

A differential is a gear-driven axle assembly which transits power from the drive shaft to the wheels. As the name suggests, a differential allow the inside wheels to rotate at a slower rate than the outside wheels in a turn. (This is because the inside wheels are traveling a shorter distance.)

IndyCar engines are mounted in the rear of the chassis, with CV (constant velocity) joints powering the rear wheels, operating with various differential configurations.

In the simulation, the differential your IndyCar uses is called a "spool." It is basically a locked differential, offering no assistance in turns. On certain tracks, actual IndyCar teams will use a "Salisbury" type differential. the Salisbury differential is normally locked, but becomes open when the car drives through a turn.

In order to make up for the lack of a true differential, you may wish to stagger the rear wheels of your IndyCar. "Stagger" is a term used to describe the diameter differences between the rear tires mounted on your IndyCar. They do not have to be the same size, and often it is desirable to run tires with larger diameters on one side of the car.

For example, you're setting your car up at the Michigan speedway. Since the oval racecourse has only banked, left-hand turns, you'll probably want larger tires on the right side of the car, or, "right-side stagger." This will cause your IndyCar to tend left, helping the car's performance in the turns. Consequently, the racecar will also want to pull to the left on the straights.

On roadcourses, novice owner/drivers should neutralize the car with not stagger. More experienced IndyCar drivers may wish to adjust stagger to compensate for a roadcourse that predominantly turns one way or the other. Choose Stagger from the Tires menu.

Stagger adjustments can be made from the garage or pit menu. It is quite common for teams who are struggling with setup on raceday to make stagger modifications first. It involves nothing more than changing the set of tires on the car, a feat that can easily be performed in less than twelve seconds. As is the case with camber, changes, in stagger are fractional, but produce big results. Note that stagger values reflect the difference between the right side wheels and the left side wheels. A negative number signifies a larger left rear tire; a positive stagger value means the right rear tire is larger in diameter.

If Only Man Had Wings...

Before the 1970's IndyCar teams relied solely on chassis setup to provide traction and handling. But in the mid-1960's a driver/designer named Jim Hall began building Chaparral Can-Am cars that sported various ground effects and aerodynamic devices to improve handling. Through the evolution of racing designs it became apparent that large, light-weight wings mounted on the racecar could better provide downforce than conventional spoiler.

The wings on your IndyCar operate much like those on an airplane. As air flow travels both above and below the plan's wings, it generates lift based upon the size and shape of the wing. Your IndyCar's wings are much like the airplane's, but they are inverted. Instead of drawing the air mass downward to create lift, the IndyCar's wings are designed to suck the air upward to push the car down onto the track. And the faster the car goes, the more downforce is generated by the wings.

Downforce applied to your racecar does not come without a trade-off. Increasing the angles of the wings on the car gives the air mass a bigger target to hit, producing more downforce. But at the same time, that means more of your IndyCar becomes subject to wind resistance. The results is something call "drag," basically a force that slow the car down somewhat.

The downforce your IndyCar generates is roughly equivalent to as much as four times the weight of the car itself. Using maximum downforce setups on the wings (both rear edges of your car's wings raised to their highest point), your IndyCar is capable of manufacturing 3-4G of downforce!

On speedways, your general goal when adopting wing settings will be utilize as little downforce as possible. This means your car will suffer less drag, while have more pure top speed. An IndyCar in the hands of a novice will be easier to drive with more wing, but certainly less competitive. Wings set a steeper angles also rob the car of fuel mileage, the duration of an entire race. Therefore, use only as much wing as you'll need to consistently lap the speedway, with some allowance for traffic (remember, you're not the only driver out there.)

An external view of your car on a speedway will show you the speedway wing kit attached to your car. These wings are smaller, designed to deflect less air mass than a roadcourse counterparts. Speedway wings operate with reduced drag, only offering the amount of downforce essential to controlling the car.

On roadcourses, more wing is necessary to provide grip to the wheels through tight corners. Depending upon the course, top speed may not be a paramount consideration. If 70% of a course layout is comprised of various corners, you'll want the racecar to be able to handle these without a lot of unnecessary braking, and you'll probably be willing to part with a bit of top speed, since the straights only account for a mere 30% of your racetrack. A steady supply of downforce from the wings will help "glue" your car to the track, allowing you to continue acceleration through as much of the course as possible.

The roadcourse trim on you IndyCar is noticeably larger than speedway wings. Vertical side tabs adorn the front wing to help cool the disc brakes, and both wings utilize individual "wickerbills." A wickerbill is a separate vertical strip that is positioned across the rear of each wing. By making fine adjustments to the wickerbill size, the car experiences subtle changes in downforce without the team's having to move the entire wing. You will not need to adjust wickerbills in the simulations.

On the left, the road course wing kit; On the right, the speedway wing set. Note the overall size differences between the two. The larger road course wings are designed to produce more downforce to help get the car through the tighter corners that are found on road courses.

Wing adjustments are made by the crew in one of two ways: The technician can position locking pins located on either side of the wings in a selection of notches. or, the wings can repositioned in finer increments by rotating a pot found under the body trim to the desired setting. Wings are designed to be quickly and easily adjusted during the intensity of a pit stop, in order to catch up with what the rest of the field is doing, or to correct an anomaly in the car's handling.

You can adjust your IndyCar's wings at any time from either the garage or pit menus. Values indicated on the adjustment screens are expressed in degree of angle of each wing. The front edge of the wings will remain stationary while the rear edge is rotated up or down to the desired setting (angle). The higher the angle, the greater the downforce, and the greater the drag.

Performing wing adjustments is a sure way to alleviate excessive understeer or oversteer. While changes in suspension settings will tend to affect these problems at lower speeds, the wing positions will determine the balance of the car at higher speeds. You can dial out unwanted oversteer by adding more wing to the rear of the car. If an understeering problem has you stumped, try adding more wing on the front of your IndyCar. This will supply better grip to the front tires resulting in a car with quicker steering response.

Steering Lock And Camber

Steering Lock refers to the steering radius of the front wheels, when fully deflected left or right. This affects the sensitivity of your IndyCar's steering. More steering lock helps your car turn sharper, but the added responsiveness could lead you to over-react. The tighter the circuit, the more steering lock you may need, while very little steering lock will be useful on ovals. Camber is a term used to describe the perpendicular angle at which your wheels reside in relationship to the roadway. Ideally, you'll want each of your tire surfaces to touch the ground equally from inside to outside.

It is extremely important to have as much tire surface touching the pavement as is possible. However, stagger, downforce, shock stiffness, brake bias and driving conditions all initiate different types of stress on your IndyCar tires. Downforce, for example, severely presses your car down onto the track, at up to four times its original weight. This kind of pressure can push the centerline of your car down onto the track, at up to four times its original weight. This kind of pressure can push the centerline of your car down closer to the ground, forcing the wheels to tilt, lifting the outside edges of the tires off the pavement. To combat this effect, you will need to adjust the camber of each tire individually, so that your car receives the best gripping power achievable.

Camber setup is one of the more time-consuming tasks demanded of the consummate IndyCar team. Adjustment is made by physically installing a shim set on each wheel, behind the brake drum. (Shims are a set of spacers provided by the chassis maker. They come in different sizes and may be mixed and matched to generate any combination of desired degrees of adjustment.) Because camber adjustments are sensitive and involve removal of the wheel assembly, they are generally not performed in the middle of a race. These figures should be derived during practice and testing sessions only.

From the garage menu, camber adjustment is found under the "suspension" category. The scale and pointer shown on the camber screen indicate the direction the top of the tire faces. When the car is actually driven, this relationship will change, though it can be minimized with stiffer suspension. Positive camber points the top of the tire outward, while negative camber points it in. Note that the scale is exaggerated for clarity, actual camber adjustments are not as easily detected with the naked eye.

To begin chamber adjustments, warm the car up over a few laps of the intended circuit. When this has been achieved, check the temperatures on the right-front tire. If the outer temperature is significantly hotter than the inner, than the out edge of the tire is overly stressed. This can be corrected by applying more negative camber to that tire. Conversely, if the inboard temperature is greater than the outer, the inner edge is being abused. This can be countered by applying more positive camber. Your goal should ultimately be to strive for balance between the inner and outer edge temperatures on each tire. When you have finished setting one wheel's camber, move to another, but do them all one at a time.

If the outer tire temperatures match, but the middle temperature is different, you'll need to correct the inflation of that tire. For instance, a tire that is overly inflated will be warmer in the middle, while a tire that is under-inflated will yield a cooler reading in the center.

Note that the camber setup will probably involve more of your time than any other tuning function. After all, the camber must be set while your racecar is static, yet the crucial matter is where the wheel cambers wind up when you're on the track. In addition, it's quite probable that no two tracks will invoke the same camber response from your IndyCar chassis. While you may be a master at Michigan, you may struggle to find solid camber settings for Toronto.

Remember that tire temperatures say a lot about how your car is handling. Make generous use of the tire thermometers display in the pits, garage, or from the black box.

Shocks: Along For The Ride

When you contemplate the role of shock absorbers on your IndyCar, you're likely to think that their primary function is to provide a smooth, comfortable ride. After all, you've seen the advertising campaigns waged by shock manufacturers, and that's the feature they always bring to mind. However, you might be "shocked" to learn that IndyCar shock absorbers handle "weightier" tasks than simply alleviating bumpy rides. (Sorry for the racing puns!)

As explained earlier in this chapter, in the section entitled "A Quick Look Under the Car," the chassis weight shifts constantly as your racecar is driven, causing the amount of grip available from each tire to change as well. This transference of weight can be offset somewhat by tuning each shock absorber to different degrees of stiffness. Each shock may be prepared from fully soft (0% stiff), to fully firm (100% stiff).

The front shocks are located beneath the nose cone of the car, between the front wheels. A removable panel in the bodywork conceals them from view. The rear shocks are laid horizontally atop the motor, near transmission. they can be accessed by removing the engine cowling. Your IndyCar shocks can be fully adjusted through their range with the simple twist of a thumbwheel mounted on each shock.

By adjusting a shock to a stiffer available setting compared to the others, more weight will be transferred at the wheel, providing less grip to the tire under racing conditions. Conversely, selecting a softer setting for a given shock will cause less weight to be transferred on its wheel, offering more grip to that tire.

The two screen shots above detail the layout of the shocks on you IndyCar. The front shocks lie side-by-side in the nose of the car, while the rear shocks are horizontally mounted above the rear of the motor.

Note: Adjust your shocks by choosing "suspension" from the garage menu. All four shocks are adjusted individually. Though IndyCars also have springs at each wheel, the "shock" setting found in the game are all-encompassing and therefore assume shocks and springs are adjusted together. As you search for the right shock setup, remember that softer shock settings result in more chassis roll, but may make the car feel easier to drive because it becomes less twitchy.

IndyCar teams generally begin their static setup of the racecar by setting the front shocks to their stiffest position, and the rear ones to their softest. This makes the car understeer, or "push." This is by far the safest condition to begin your setup with because it forces the driver to back off the throttle in corners until the team can achieve competitive response. If the car were prepared with oversteer right out of the box, the driver would most assuredly overreact, and possibly trash a $400,000 machine before completing a single test lap.

As you begin your initial practice laps around the racetrack, try to discern the most crucial corners of the circuit. Set your chassis up to get you through these in the quickest, most consistent way possible. For example, your car is ill-handling through the arduous left hand turns at Monterey. You'll need to neutralize the shift of weight that occurs on the right side of your IndyCar in these curves, in order to get through them faster. You can do this by stiffening the shocks up font, giving your car quicker response, thanks to a reduction in chassis roll. Study the diagrams in the aforementioned weight transfer section of this book to get an idea of how the shifting loads affect each tire's grip under various conditions, and remember: the stiffer a shock is relative to the others, the faster that wheel will lose its grip with the pavement.

Picking Gear Ratios

The size of the cogs inside your IndyCar's transmission determine how much power the engine can supply the drive wheels in each gear. Though there are over two hundred possible combinations, the size ratio between each gear must be derived by an exact process, in order to obtain peak performance.

All of the gears inside the transmission spin at the same rpms. Larger cogs (known as taller gears) can travel a greater distance than smaller ones can. Hence, sixth gear will probably be the largest cog in the transmission, while first gear will be the smallest (shortest). It takes an IndyCar mechanic a little over an hour to install the selected gearing, so making wise ratio decisions prior to raceday is essential.

Start by setting up top gear (sixth). Find the longest straight on the track, and resolve how much top speed you need to be able to carry down it. This decision may be the product of many factors, such as length of the straight, what type of corners abut each end, and traffic. Once you have arrived at a conclusion, test range of gear sizes speed without over-revving the engine. You'll want sixth gear to top out at about 12,500 rpms.

When sixth gear has been established, most IndyCar teams select the remaining gears in 1,000 rpm increments. However, you may have different objectives in mind when picking the other gears an it is perfectly sane to try to meet them. For instance, you may want to get through the gearbox very quickly (known as tight gearing) on some tacks. Or you may not even want to use all six gears, in which case you would set fifth up as top gear.

Bear in mind this important fact: Though 1,000 rpms between gears is a proven guideline, these ratios may not fit comfortably with the layout of certain tracks. You may opt for ratios in different increments to better suit the more crucial corners. Additionally, some racetracks may "divide" your gearbox. For example. 80% of a given course might depend on gears 1-4, so you may want these ratios to be a little tighter than those between fifth and sixth.

One revolution of the larger gear produces about twice the distance of the smaller one. When selecting gears, remember that the smaller the number, the larger the cog. Larger gears have less torque, but cover greater distance.

Managing The Turbocharger

No matter which IndyCar engine you elect to power your car with, it will come with a factory-prepared turbocharger. A turbocharger is basically a pump device mounted behind the intake manifold atop your engine. It enhances your car's overall acceleration performance by forcing more air/fuel mixture into the engine than normal aspiration could provide. The beauty of the turbocharger is that it requires no hp from your IndyCar's engine to function. Instead, it is powered by exhaust gases as they exit the manifolds. The exhaust pressure rushing out of the engine spins a rotary turbine located inside a turbocharger, which pushes compressed air/fuel mix into the cylinders. Since the air borrowed from the tailpipe is rather hot, the air/fuel mixture is passed from the turbocharger through a radiator called an "intercooler" before hitting the cylinders.

The driver has complete control over the turbocharger from within the cockpit during a race. The digital display on the black box also indicates currentboost (turbocharger) pressure. Maximum allowable boost is 45 in/Hg, or 22psi. This rule is enforced through the installation of a wastegate or "pop-off valve" to your turbocharging system. Should the turobcharger begin to send any more pressure than max. legal to the cylinders, the pop-off valve will break loose, releasing the pressurized air into the atmosphere. This safety measure was invoked when it became evident that IndyCar engines produce nearly twice the hp under boost than without!

It is important to note that while an increase in turbo boost exaggerates the car's acceleration, it also lowers the car's fuel economy. Over the course of 500 miles, a one or two position change in turbocharger setting can mean the difference in the number of pit stops your car will require. Additionally, by running your turbocharger at 100% continuously, you'll find you have no boost in reserve when you really need to execute a crucial pass or catch the pack. Your turbocharger is much more than a glorified throttle. Properly employed, it presents the driver with strategic weapon!

On speedways, expect to use greater turbocharger settings, given the fact that speed is of the essence. However, prudent racing sense should lead you and your IndyCar team to the conclusion that you'll need to go faster for certain periods throughout the race than others. You'll want to make sure your engine can withstand the punishment of 500 grueling all times. On road circuits, braking and exit speeds in the corner takes precedence over raw speed. IndyCar teams generally use less active boost, which in turn leaves more power in reserve. The driver will generally only make minor adjustments to the turbocharger during the span of a roadcourse event.

Anti-Roll: This Sway And That

As you drive your IndyCar through lap after lap, several factors begin influencing the overall feel, or "feedback" of its chassis. First, your engine is burning the fuel stored onboard, gradually reducing the total weight of the car. Each gallon of methanol consumed by the motor eliminates roughly six pounds of cargo; You'll notice the effect of such a drastic weight reduction on the car's speed. This welcome added power comes at a sacrifice of some of the car's handling. Second, your tires are wearing down, providing you with a little less grip than they did a few laps ago.

How do you combat these "changes in motion?" Inside the cockpit, on the driver's left-hand side, you'll see three levers, resembling gear shifts. The two most left-hand levers control the anti-roll bars (also referred to as "sway bars") equipped on your IndyCar. Connected to the anti-roll bars via steel aircraft cables, these levers mechanically rotate tension rings affixed to each bar. By adjusting these as you drive, you can counteract the subtle alterations in handling that occur from lap to lap.

The anti-roll bars are solidly bolted to the chassis between each set of wheels on your car. One extends between the two front wheels, the other between the two rear. Here's a quick synopsis of what anti-roll bars do for you: First, they minimize chassis roll that occurs while cornering. This allows you to better control camber changes that take place due to weight transfer. The car is much more responsive in the turns than it would be minus the anti-roll bars.

Second, they afford the driver a way to compensate for any unwanted understeer or oversteer found in the car while it is out on the track. You can correct an understeering problem by stiffening the rear anti-roll bar, or an oversteering car by stiffening the front bar. Attentiveness to these adjustments will help keep a well balanced car out there all the time.

Like shock absorbers, anti-roll bar setting can range from completely soft to fully stiff. And like shocks, stiffer anti-roll bar settings will help minimize the chassis roll rate, but generate more weight transfer resulting in smaller tire contact patches and less grip.

Don't get caught with an ill-handling racecar! Remember to keep abreast of the car's handling on every lap. As the car's response changes severely, compensate by readjusting your anti-roll bars. Always try to set the rear bar slightly softer than the front to avoid oversteer.

A fully stiff front anti-roll bar combined with a fully soft rear anti-roll bar will produce understeer in the car's chassis (the front wheels losing grip before the rear ones). This is the base that every IndyCar team begins building from. During testing or practice sessions, start you setup process with stiff front suspension and soft rear suspension, then gradually readjust as you drive, in order to "dial in" the handling you need to score a win.

Remember to leave yourself the opportunity to compensate for changes in handling characteristics as you drive. Try not to race with both bars adjusted to fully soft positions, or you'll eventually be seeing the race from Papyrus General Hospital! Also, bear in mind that you need not adjust these levers during every lap. Only reposition them as you detect large levels of deterioration in the car's handling, or when your on-track goals must change.

The Black Box

At the heart of the IndyCar's cockpit instrumentation lies the digital display known as "the Black Box." At a glance, it appears to be a detailed, easy-to-read data screen. It is this, but it is also much more.

The Black Box installed on the dash of your IndyCar is designed to afford the driver with a quick, precise, "heads up" displaying detailing all of the appropriate numbers of interest during a race. Current speed, rpm, turbo boost pressure, engine temperature and remaining fuel are generously conveyed to the driver, as the car is in use.

The Black box clearly displays current speed, rpm boost pressure, engine temperature and other pertinent data.

The digital display is much more efficient at showing the driver critical info than its analog counterparts, thus improving decision and reaction times in the car.

Beneath the surface, the Black Box is a sophisticated on board computer system that regulates and controls most of the serious engine functions. Fuel injectors are monitored and utilized by the computer. Amount of fuel sprayed into each cylinder is calculated by the Black Box, based on a variety of factors such as speed, timing and temperatures within the IndyCar engine. The computer performs this function on a constant basis for 500 miles! In addition to watchdogging the sequential multi-port fuel injection system on your racecar, the Black Box also scans ignition timing. Taken off the crankshaft, precise timing figures are available to the team via computer readout.

Finally, the Black Box is an elaborate data storage system, with the capacity to monitor over fifty onboard sensors at a given time. This information is stored in the computer, than downloaded onto a PC at virtually every pit stop. The information gathered by the crew can be applied to the car at the subsequent pit stop. The Black Box also has the capability of translating interactive telemetry to team headquarters, as the car is being driven on the other side of the globe! This means that as you drive you IndyCar around the track at New Hampshire, a team engineer back in England could watch your car's performance and tune the engine from this location. Though this feature is not yet permitted in CART competition, it makes for some astounding possibilities!

Finding More Speed

Adjusting The Brake Bias

Through the rigors of an IndyCar season, you will demand a lot from your racecar. One of the most important tasks you will want your IndyCar to perform will be that of braking. Race in and race out, the variation of the tracts on the IndyCar circuit present different sets of goals for your brakes. You, as the driver of the car must have complete control over this area to help preserve the integrity of the team's effort.

Under totally neutral circumstances, the brake pads on all four wheels of your IndyCar would activate at the same memento that the pedal is applied. This is generally undesirable, because weight shifts forward during braking. The brake bias adjuster lets you decide whether your front brakes will begin stopping the car before the rear ones do, or vise versa. IndyCar teams can have the front brake grab before the rear brakes do by adjusting brake bias forward. Likewise, the rear brakes can begin to work just ahead of the front brakes by setting bias to the rear.

IndyCar teams like to have extra bite in the brake system to cope with road circuits, so most teams begin their setup with brake bias slightly to the front. Coupled with the forward load transfer, the early front brake action provides maximum stopping power.

On speedways, the car's braking system plays a much smaller role. Brakes do little more than help dodge traffic and stop the car in its pit. Teams move their car's brake bias slightly to the rear in order to give the driver more control when braking in a corner.

Your brake bias adjustment lever is located on the left side of the cockpit, just to the right of the anti-roll bar adjusters. The digital gauge on the panel above it indicates your current bias position. The bias adjuster in your cockpit is connected to the master cylinder, assigning priority according to the lever's position.

Although you can alter the brake bias setting as you drive, constant changes of this adjustment are not recommended. If the other drivers are out-braking you in the corners, or you must drive on tires that are excessively worn, you want to make a bias adjustment. Otherwise, you'll want to find a comfortable setting that will last the entire race.

*Set your brake bias slightly forward on streets and roads, while moving it slightly to the rear on speedways. Use the "**:**" key to move the lever backward, and the "**'** " key to move it forward.*

Finding More Speed

After months of seemingly endless preseason testing , it's finally here. The initial even of the IndyCar season is upon you, and the sheer electricity of competition has everyone pumped. Mechanics scurrying about, sponsors offering nervous well-wishes and the media wanting to know who you are, and how you got here. You know you can drive, you've got the test lap times to prove it. But now here you are, about to participate in the "show," as the other drivers quietly refer to do it.

You climb into your Lola for the morning practice session, and you work out on the track with your setup, prepared to dice it out with the best the world of IndyCar has to offer. Though you heed all of your chief mechanic's frantic suggestions, you just can't hang with the pack. As the other racecars buzz by, one, two, three-you get a sinking feeling in the pit of your stomach, as if the other drivers and the whole racing world have learned the awful truth: You're not fast enough.

The next few pages are geared to offer you a few additional tips and ideas for squeezing a few extra drops of speed from your car, in the hopes that you too, will one day capture the coveted IndyCar title.

Getting A Better Grip On Your Car

If you are using a joystick device to control you IndyCar, you may find it much easier (especially during grueling 500 mile races!) to place a thick book or board across your lap, allowing the joystick base to rest upon it. This will allow you to control the stick with one hand, while freeing the other hand up to access the keyboard for turbocharger/anti-roll bar/brake bias adjustments.

This suggestion may also add a great deal of stability to your driving style. Holding the stick in a consistent manner will help produce consistent laps from mile-to-mile.

Developing Speed In The Garage

Following the garage menu in order can ease the setup process somewhat. It starts with the tires and ends with the gearbox, presenting a logical path for IndyCar engineers to follow. You should also try one of the three "out of the box" setups before you start from scratch. Each of the three preset setting files are custom made to suit each track.

Every alteration you make to your IndyCar's setup should produce at least one of two things: speed and/or tire grip. Try to think in these terms when you are tuning your car. Isolate your questions about the car's setup to each individual component, and try to answer them one by one. For example, work on rubber compounds at each wheel before moving on to tire pressures.

As you make subtle changes to the car, drive some practice laps to discover the effects, then return to your garage for some fine tuning. Remember that as you make changes to one area, another might be affected. Adding more wings to the car, for instance, may change the camber settings and warm tire temperatures on each wheel, in addition to creating more drag to slow your IndyCar down. Therefore, it is a good idea to go back through the garage menu once more when you've finished setting your car up, to ensure that your tweaking hasn't caused other areas to fluctuate.

Don't expect the drive the same car at New England that you did at Michigan. The car setup that got you down the Michigan backstretch at an impressive 235 mph will put you into the wall at New England. Speedways, short ovals and road tracks each require completely different results from the car, and must be dealt with accordingly if your team is to win the championship.

Developing Speed In Practice

In order to learn to drive your IndyCar within its maximum limits, you'll need to put several practice sessions in at the track, just like the actual drivers do. Your practice sessions should include topics like: overtaking other cars, getting in and out of the pits, and controlling your car in the event of a spinout. IndyCar drivers are known to log as many as 600 miles during a single test session, so above all, be patient.

Use some of IndyCar Racing's extensive features to help you ascertain track knowledge. Having trouble finding the proper gear for each turn? Try using the "automatic shifting" feature. Even if you prefer the realism of a manual transmission, the autoshifting feature can be used to your benefit during practice, allowing you to study textbook quality work on the gearbox. Can't seem to "get it right" in a hairpin turn? Study the instant replay footage to point out flaws in your entry and exit points of the corner. You might find the blimp view to be a valuable asset here.

Developing Speed In Your Technique

Perhaps the answer to lower pal times lies within your cornering method. Entering a turn, you might be able to brake a split-second later than your opponent, while getting back on the throttle a heartbeat quicker than the other drivers can pay big dividends at the corner's exit.

Every driver should know that the apex for each corner may lie at a different point within the turn. The apex is commonly mistaken as being the exact midpoint of a turn. In reality, it is the point in the corner at which you can stop braking and begin applying throttle again. This is also the point at which your car should be the closest to the inside of the turn. The location of this area depends upon the angle of the turn, and your car's capabilities. As a rule of thumb, taking a wider entrance line into a turn produces a closer apex, allowing you to stand on the gas sooner when exiting.

Drafting- When And How

Drafting, or "slip-streaming" is the art of using cars directly in front of you to temporarily break the oncoming air, allowing you to carry a bit more speed. Drafting is a phenomenon that occurs at speeds at 70 mph or greater.

To gain realistic advantages from drafting, you should know where the possible locations on the track are that will offer you the room needed to employ it. Long straights and fast curves are best, while tight corners keep the speeds too low for consideration.

Carefully set your opponent up for the drafting maneuver. Give patient chase for a few laps if necessary, until the key elements are on your side. First, that aforementioned fast area needs to be in place. Second, you don't want the traffic ahead to be too heavy. Third, drafting into a tight corner can be hazardous. If you just manage to sneak by your opponent at the end of the straight, you may find yourself going too fast to drive the proper line through the turn. For this reason, you will probably find speedway drafting to be much more common and useful.

As you tuck in behind your opponent, you will feel the draft begin to pull you closer to his car. Your speed increases as you draw nearer to the other car's engine compartment. At the last moment, drive a smooth, quick line to the inside to continue the drafting advantage as you blast be your rival. Check the road ahead for rapidly approaching brake points, and glance in you rear views to see the recently vanquished opposition fading back! Remember, too, that your opponent might be longing to pay you back on the ensuing lap, so be wary.

You should know that your IndyCar suffers a temporary loss of downforce while drafting. The drag that would normally be exerted upon your IndyCar is blocked by the opponent you are drafting off of. Therefore, it is not wise to continue the drafting technique into a high speed corner that requires any level of downforce.

Developing Speed In The Pits

It is vital for every IndyCar driver to know exactly where the team's spot along the pit wall is. Find this designated section in practice, and rehearse exact stops over and over. You'll need this level of precision to achieve the lowest possible pit times.

Take only the supplies you need to get the job done. Don't replace your front tires if the existing ones still have many miles left. Don't fill the tank completely at your last pitstop if a quick "splash and go" of a few gallons will get you to the finish line.

When you stop in the pits, or drive extensively under the yellow flag, you can expect your tires to cool down. This results in lost grip when you bring the car back up to speed. In situations where your tires are likely to be cold (such as taking on a fresh set), you may find it extremely helpful to drop your boost setting by two notches for few laps, until you can elevate your tire temperatures again.

One Final Secret

At the start of most races, your tires will be cold. You can warm them up on the pace lap (if the lap feature is enabled) or under yellow be weaving side-to-side as you drive. You'll see the ether drivers employing this same technique, as it is proven to be quite effective. Like everything else that happens behind the wheel, this is a tactic you should rehearse beforehand. Great drivers make this maneuver look easy, but skill is needed. You won't have much downforce working for you, because the slow speeds of the pace laps or yellow flag periods don't allow the wings of you racecar to build enough of it. You will essentially be driving without the aid of your IndyCar's wings during these slow laps. Also, other competitors are warming their tires in the same way, and tagging another car with yours is easy to do if you're not careful.

Troubleshooting In The Garage

Adapting you IndyCar's setups to meet the demand of each racetrack is an art in itself. Each adjustment to a single component of the car can affect other areas. In order to help you understand the scope of each change made in the garage or pit, we've provided some basic information below for your review.

Tire Compounds: The harder the compound, the longer the tire life. A softer compound won't last as long, but gives you better grip.

Tire Pressures: Lower pressure can sometimes improve grip by raising the temperature of a tire that's just not warm enough. However, this can decrease the tire life and slow the car down a little due to the additional rolling drag.

Stagger: More stagger will help get the car around the left turns of an oval quicker, while causing the car to pull slightly left on the straights. Less stagger may be chosen to aid a car throughout a right turn-dominant road course.

Wings: More wings increases downforce, improving tire grip and handling, while slowing the car down. The added downforce can also make the top surfaces of each wheel point further inward, calling for camber adjustment. Less wing has an opposite affect- less downforce, less tire grip, more top speed.

Camber: Helps the wheels cope with the effects of downforce and chassis roll. In general, you'll adjust camber on each wheel so that inner and outer tire temperatures match. This creates the best overall grip.

Shocks: Stiffer shocks minimize chassis roll, giving you more responsive steering and better camber control. Softer shocks create a more forgiving chassis, though less responsive.

Gearing: Larger gears offer more top speed, while smaller gears offer more acceleration. The distribution of gear sizes can produce a variety of results, from on-demand quickness to flat-out speed.

Anti-Roll Bars: Tightening the front anti-roll bar reduces oversteer, tightening the rear bar diminishes understeer.

Brake Bias: Bias forward gives you more stopping power up front, but creates some understeer under braking. Bias rearward moves more stopping power to the back of the car, giving you less control under braking.

Turbocharger: Increasing the turbocharger setting delivers more horsepower to the engine, resulting in greater top speed. Adversely, the engine sustains more wear and tear when run with higher boost pressure, and fuel economy suffers as well.

IndyCar Racing contains a set of three suggested car settings for each track**Easy, Fast and Ace** These files provide players with a series of building blocks with which to start. Default settings at each circuit are taken from the **Easy** file, intended to produce a slower car ideal for beginners who are learning the game.

Utilizing the **Fast** setup provides an intermediate blend of handling and speed. The **Ace** package is designed with an eye toward achieving utmost top speed, and should only be used by more experienced IndyCar drivers. It's a good idea to try one of these setups at first, then modify it to suit your individual driving style.

The Setup Doctor Is In

Problem	**Remedies**
Car Won't Turn Sharp Enough use (Understeer)	Increase front wing, tighten rear anti-roll bars and/or stiffen shocks, softer compounds up front, move brake bias rearward.
Car Feels Loose in Turns (Oversteer)	Increase rear wing, tighten front anti-roll, stiffen front shocks, use softer rear tires, move brake bias frontward.
Car Lacks Top Speed	Decrease amount of wing, use longer gear ratios, raise boost pressure.
Car Lacks Acceleration	Use tighter gear ratios, raise boost pressure.
Engine Over-rev Light Blinks add	Shift up sooner, decrease turbocharger setting, install longer gears, wing.
Car Loses Grip In Turns At Very High Speeds	Slow down, try softer compounds, adjust camber to even tire temps, tighten front anti-roll, use lower tire pressures, softer shocks, more wing.
Animation "Too Jumpy"	Decrease detail level for your computer to speed up the game's animation frame rate. Faster machines can handle more detail. Smoother animation makes the car easier to drive.

IndyCar Racing Appendixes

"Hey, Where Did IndyCar Racing Come From?"

Shortly after the birth of the automobile, a Paris newspaper staged what is believed to be the first organized motor race in the world. Though fewer than twenty entrants actually crossed the starting line, it was this event, circa 1894, that would serve as the catalyst that launched man's passionate search for the definitive fusion of speed, technology and driving skill.

Racing Comes To America

Impressed with the hoopla surrounding the race in France, a Chicago newspaper decided to assemble a similar event in the United States. The 54 mile race was run on public roads, and won by Frank Duryea, who averaged less than seven miles per hour in outdueling the other five entrants. Capitalizing on the sure-fire success and growing public interest that was created by each auto race, newspapers across the globe began to host automobile competitions. Many of the spectators at these events were curiosity seekers, getting their first look at these newfangled horseless carriages!

As the popularity of auto racing began to grow, so did the number of men in racing garages, each one bent on finding a way to make the fastest car in the world. Many of these men were decent mechanics, but lacked any real understanding of driving tactics and car control. Consequently, as crowds increased in size, turning out in droves to line the streets of the race course for each event, the poor mix of novice drivers and unprotected race fans led to horrid accidents that would cause local governments to impose bans on any future auto races in their areas. Promoters sought to contain the probability of such incidents by turning to dirt horse tracks located on public fairgrounds. A wealthy Englishman had the first bonafide motor racing track built at Brooklands in 1906. The concrete, oddly shaped oval was almost three miles long and included a finishing straight like those found on horse tracks!

Indianapolis Gets Its Start

In 1909, a group comprised of four local businessmen developed the Indianapolis Motor Speedway. The effort was spearheaded by Carl Fisher, co-owner of the Prest-O-lite headlamp company. The original track was designed by P.T. Andrews. This 2 and a half-mile oval has enjoyed a much longer lifespan than any other main-line racing venue, in spite of the fact that average lap speeds have climbed from less than 75 mph to over 230 mph! Though the original track surface consisted of crushed stone and tar, the initial race at the speedway left it badly damaged, to the extent that by the end of that first year it had been resurfaced with 3,200, 000 red bricks- enough to fill 500 railroad cars! Dubbed "The Brickyard," the first race was a short sprint won by Louis Schwitzer, and the first major event was a 250-mile race won by Bob Burman. Sadly, this race was also tarnished by Indy's first fatal accident.

In 1911, the Indianapolis Motor Speedway introduced its first 500, called "The 500-mile International Sweepstakes." Since then, virtually every Memorial day has been earmarked by the running of the Indianapolis 500, save for brief lapses during the World Wars.

Paydays and Heydays

Though the Indianapolis Motor Speedway hosted several events throughout its first two years of operation, Carl Fisher wanted to orchestrate something unique. He decided the speedway would be the site of only one race per year, that being a 500 miles event held on Memorial day. Fisher also wanted his race to offer the largest winning paycheck, so he raised to an unheard of $27, 550! The attractive prize money and well-earned fame attached with winning the 500 quickly caught the eye of the international racing world. All of the reasons to dream of winning the Indianapolis 500 were now in place, and every man with a penchant for auto racing began to set his sights on becoming its champion.

Early Automobile Ingenuity

IndyCar competition now provided the perfect incentives to become the proving ground for technical advancements in automotive design. Not only were the cars going faster, they were getting more rugged as competitors began searching for ways to make 'em fast, and make 'em last! Early efforts were promising: the first racecar featuring monocoque construction was crafted for IndyCar competition prior to World War I.

Known as the "Cornelian, " the car had independent front and rear suspension and performed favorably in the 1915 500. The Chevrolet brothers, who designed and built the Cornelian, turned their attentions to other design innovations almost immediately. By the start of 1916, the Chevrolet brothers had pioneered the use of light-weight aluminum in racecars. Nearly 500 pounds lighter than the competition,

these cars dominated American racetracks for the next four years. About this same time, AAA established a series of races to serve as sort of a national championship.

As prize money continued to escalate, so did top speeds. In 1919, IndyCar fans saw the first 100mph laps recorded in qualifying, with seven drivers eclipsing the century mark. Peter de Paolo became the first driver to average over 100 mph for an Indy 500, winning the 1925 race in a Duesenberg.

In 1926, Henry Miller designed and built an engine that would later become known as the Offenhauser, or "Offy." Originally built to serve as a powerboat engine, it met all the criteria necessary for success in the IndyCar world. It was small, light-weight and very powerful. Incredibly, this engine would become the primary IndyCar engine of choice for the next 50 years! Cosworth would finally break the Offy's hold on IndyCar racing in the mid-1970's.

For Sale: One Speedway With Accessories

At the height of racing in the roaring twenties, Carl Fisher sold the Indianapolis Motor Speedway to Eddie Rickenbacker in 1927. Rickenbacker, former World War I ace pilot and racecar driver, guided the speedway through the depression years. Fisher had first approached two-time Indy 500 winner Tommy Milton about purchasing the track, but Milton wasn't interested. Rickenbacker paid $2,000 per acre and almost right away, began a series of sweeping repairs and renovations to the facility which had become infested with weeds and wear.

The Junking Of Progress

IndyCar racing was still under the authority of Triple-A, and in 1930, the AAA contest board produced the infamous "junk formula." Created to curb the climbing costs of auto racing, these were simply modified passengers cars, bringing back the need for riding mechanics. These changes in the overall formula requirements also brought stock block engines to IndyCar racing. Although the new regulations were scorned by drivers, the move to hold racing costs within reason was the only way many of them stayed employed!

The junk formulas created temporary setbacks in racing's technological advancements, but some teams still managed to be innovative. Perhaps most significant of the few developments of this era was the early use of in-car communications. Leon Duray became the first IndyCar driver to talk to his crew via radio in 1932!

By 1935, racing needed safer guidelines in order to flourish, therefore, crash helmets became mandatory for all participants in IndyCar racing. Prior to this time, drivers wore a canvas helmet that did nothing more than keep their hair out of the face. The helmets of 1935 were not much better, however- "puddin' bowl" helmets originally made for polo players.

As trends in the racing world gravitated toward safety and reliability, riding mechanics were gradually becoming nothing more than glorified passengers, and were this utilized for the last time in 1936. At Indianapolis, Eddie Rickenbacker widened the speedway's turns, creating a somewhat safer environment. The following year the track was paved with asphalt, speedway management leaving only a stretch of bricks exposed along the front straight, kept only for sentimental reasons. All that remains of the brick today is a lone stripe, located at the start/finish line.

The Age Of Adaptation

By the late thirties, the country was winding its way out of the great depression, and auto racing was again stimulated by a burgeoning economy. With the invention of the automobile itself still occurring less than fifty years prior, there remained much room for ingenuity. Hence, the first racecar to feature disc brakes debuted at the 1938 Indy 500. The car, a rear-engined Gulf-Miller, actually used pressure plates working on one face of a disc for stopping power. The car sadly became a huge four-wheel drive flop, despite technology that was viewed as "ahead o fits time." However, the Gulf-Miller experiment was typical of the leaps that designers were willing and able to make now that the proper funds were available. For all its shortcomings, the junk formula had somehow served its purpose- racing was still alive, and the will to win still burned deep within the souls of every IndyCar team in existence.

Drivers became the benefactor of new-found automotive advances, and as a result their accomplishments became more noteworthy. Wilbur Shaw became the first driver to notch back-to-back Indianapolis 500 wins, achieving this feat in the 1939-40 contests. Shaw's Maserati also dominated the race in 1941, but he clouted the wall on lap 152. Ironically, it was also Wilbur Shaw who would later be charged with the task of locating someone interested in buying the Indianapolis Motor Speedway, which had been put on the block by Eddie Rickenbacker.

IndyCar Gets An Organization

In 1945, Anthony Hulman bought the track from Rickenbacker for $700,000. Hulman named Wilbur Shaw as President of the speedway, and began an aggressive mission of renovating the dilapidated oval. The track had suffered greatly from the result of years of neglect, brought about by World War II.

In 1950 the point system for the driver's World Championship was established. Although the Indianapolis 500 no longer conformed to the Grand Prix formula as it had from 1938 through 1941, it was considered the American event for the points championship. This created some wild year-end points between American IndyCar drivers and foreign Grand Prix drivers. Indy was dropped from the worldwide points chase in 1958.

By this time, racing was fast becoming a true science of design. In 1951, Ted Halibrand built the first magnesium wheels that reduced weight. Halibrand also invented the first quick-change differential that allowed rear axle ratios to be adjusted in the pits. Monroe built the first tubular shock absorbers for an IndyCar in 1950. Within a couple of years, every IndyCar used them. The first turbocharged IndyCar was the Kurtis/Cummins diesel roadster which won the pole at Indianapolis in 1952. The sport was maturing, the speeds were increasing, and the need for a more committed ruling organization was becoming evident.

In 1955, AAA finally elected to leave auto racing, partially because of the danger involved. In need of a governing body, Tony Hulman helped launch USAC (United States Auto Club). The new group legislated almost every type of auto racing imaginable, from midgets, to sprint cars, stock cars to sports cars. But USAC's pride and joy has always clearly been the Indianapolis 500.

The Fabulous Fifties

Now that IndyCar racing was an established attraction, sponsorship money began to push the buttons of technology once again. Frank Kurtis built the first 'roadster' in 1952. This design laid the Offenhauser engine down on its side, creating a lower center of gravity in the car. Kurtis' chassis layout allowed his cars to get through speedway turns more than 10 mph faster than conventional IndyCar of that era, and Bill Vukovich posted impressive back-to-back victories at the Indy 500 in Kurtis creations.

In the late fifties, IndyCar racing gained a new visionary. Newcomer A.J. Watson built the first IndyCars using fiberglass bodywork in 1956. He also pioneered "weight jackers," the first in-car suspension adjusters that allowed drivers to compensate for weight transfer as they drove. Watson-built cars would rule IndyCar racing until the early sixties, when the move to rear-engined beasts effectively wiped them out.

Now that designers were beginning to define the IndyCar as a one-of-a kind breed, the circuit itself had to grow. It was apparent that IndyCar racing could not survive forever on one single event. Now that Formula One was moving away from the inclusion of IndyCar results in its championship, the time was ripe for expansion, thus 1958 became a pivotal year for USAC's venture into road racing. The organization launched a full-fledged Road Racing Division, running four events that gave the first overall title to Dan Gurney.

Moving From Front To Back

In 1962, Parnelli Jones became the first driver to crack the 150 mph barrier at Indianapolis, accomplished during his qualifying run. Jim Clark later became the first driver to average over 150 mph throughout the race upon winning in 1965. This was also the first Indy win for both a British constructor and British driver. That impressive performance was turned in by a rear-engine design put together by noted Briton, Colin Chapman. Chapman had begun with a design John Cooper first pioneered in 1946.

Because most car owners had already poured many thousands of dollars into their traditional front-engined designs, the move to the rear-engined IndyCar was met with stern resistance. Formula One had already undergone this transformation, and it was evident that the rear-engined designs were more controllable. And as the race results began to pile up heavily in favor of the rear-engined cars, the switch was on.

At last, the Offy-powered "roadster" cars were beginning to fade from view. Not only were the new rear-engined cars sleeker, they were safer. The last time a front-engined car won the Indy 500 was in 1964, when A.J. Foyt triumphed. Foyt had the opportunity to drive a rear-engined car in the race, but elected to stay with his "Watson" instead. The last front-engined car to take a checkered flag at Indianapolis was driven by Eddie Johnson in 1965.

Though is was an evolution that lasted nearly seven years total, rear-engined popularity actually had taken hold in just a couple of seasons. And, in 1968, the roadster era was officially put to bed when Jim Hurtubise's Mallard dropped out of the Indy 500 after just nine laps.

Growing Pains

The first USAC Championship event on a road course was staged on July 25, 1965. The 150-mile race was called "The Hoosier Grand Prix," and was held appropriately at Indianapolis Raceway Park. A then-obscure driver named Mario Andretti won, taking the checkered flag when A.J. Foyt ran out of gas on the final lap.

The first Indycar race in California since 1936 was held in November, 1967. "The Rex Mays 300" was won by Dan Gurney, in his own "Eagle" car and "Eagle Ford" engine. Gurney withstood a flat tire, faulty clutch, several protests, a fierce charge from Jim Clark before blowing an engine, and Mario Andretti, who ran out of fuel three laps from the finish line while in the lead.

This gave the overall Indycar season championship to A.J. Foyt, who had been deadlocked with Andretti and Gordon Johncock for the points lead.

Andy Granatelli raised the eyebrows of USAC's rules committee when he rolled out the first wedge-shaped IndyCars in 1968. Designed by Lotus, the four-wheel-drive cars were powered by a Pratt & Whitney gas turbine engine. This was actually a very competitive design; Parnelli Jones came within a scant few miles of winning the Indy 500, before the car suffered a minor technical problem in the waning moments. USAC eventually decided to reduce the allowable air inlet area of gas turbine engines, quickly rendering them uncompetitive.

In July, 1968, Al Unser, driving a Lola Ford, Became the first driver to pilot a four-wheel-drive car to a road race win in America. Unser out-dueled Mario Andretti at Indianapolis Raceway Park. USAC later banned four-wheel-drive vehicles from competition, noting that these cars were extremely hard to steer if the front wheels were transmitting any effective power.

New Kids On The Block

In 1968 Roger Penske made the leap from successful driver to successful constructor. After a brief stint in Formula One competition, he turned his attention to IndyCar racing, tasting victory first with driver Mark Donohue in the 1972 500, and later capturing the 1979 500 in a PC6 driven by then little-known Rick Mears.

In the mid-70's, a few talented women made their way into IndyCar racing. Among these, Janet Guthrie passed the rookie driving test in 1976 and became the first female driver to attempt to qualify for the Indy 500. She made the field in 1977, and had a respectable 9th place finish in 1978. Currently, Lyn St. James is a formidable contender on the IndyCar circuit.

A.J. Foyt became the first four-time winner of the Indianapolis 500 in 1977. Tom Sneva also turned the first 200 mph lap in speedway history, earning him the nickname, "Tommy the Gasman."

IndyCar Picks Up Speed

In order to give team owners a greater voice in the future of IndyCar racing, CART (championship Auto Racing Teams) was formed in 1978, eventually creating the CART IndyCar series. The new organization's inaugural event was a 150-mile race at Phoenix International Raceway. Gordon Johncock was able to fend off Rick Mears and take the checkered flag, by a margin of one second.

Among the significant advances in IndyCar technology, one development from the early 1980s stands our in particular: Ground effects were implemented by Roger Penske. This feature allows a vacuum beneath the chassis to be formed, causing the car to be sucked toward the pavement at high speeds. Jim Hall, who is credited as the father of downforce and ground effects, built the car Johnny Rutherford won with in 1980.

Legend Of Today

In 1987, Al Unser became the second driver to win the Indianapolis 500 four times. He almost didn't even compete in the race-after Unser showed up at the speedway without a team, car or sponsor, Roger Penske decided to let him drive a spare racecar at the last minute. The car was a left-over that Penske had been displaying in auto shows around the country!

Rick Mears joined the Indy 500 four-time winner club in 1991, after staging a brilliant duel with Michael Andretti in the closing laps. Andretti made a rare pass of Mears on the outside of a turn, but on the next lap Mears duplicated this feat with the same maneuver. The first IndyCar race to be staged overseas also took place in 1991, at Surfer's Paradise, Australia. The first six races of the 1991 season produced six different winners, a wonder that IndyCar racing had not seen in over thirty years!

The 1992 IndyCar season proved to be one of the most richly diverse on record. Six different drivers won races throughout the season, and the final race offered a shot at the overall championship to three different drivers. Engine and chassis combinations were distinct as well: the top four finishers in the point standings drove three different chassis, and three different engines.

1993 again provided IndyCar fans with a hotly contested series, as Nigel Mansell outdueled Penske drivers Emerson Fittipaldi and Paul Tracy for the championship. Although Mansell was but a rookie on the IndyCar circuit, he was no stranger to the cockpit of a racecar. He had carved up the Formula One field a year earlier while on his way to becoming the first British champion in over fifteen years. Mansell won five races and finished the 1993 campaign just eight points ahead of Fittipaldi.

All of the sixteen events Indy Car staged in 1993 were broadcast nationally. Nine of the races were aired on a major television network, making the sport more accessible to potential fans.

"What Is An IndyCar?"

By now you've probably installed the program and driven the car around a track for a few "warm up" laps, or some races. Maybe you've even experienced a crash or two, or a "shunt," as we say in racing. But what about these IndyCars, and how do they differ from Formula One? After all, they look similar!

Your IndyCar is a monoposto vehicle, a term meaning that it has only one seat. It also features a monocoque design, meaning that the body and chassis are unitized into a single component. It takes over a quarter of a million dollars to construct a single IndyCar, using all of the latest developments in automotive technology. The body work on your IndyCar is manufactured from carbon fiber materials, a durable, yet lightweight composite. The wheels are made from magnesium, also providing the benefits of sturdiness without compromise to the racecar's weight.

The sponsors of your IndyCar entry have paid over a million dollars to have access to a season's worth of engines. The brake pads on your racecar can cost your team as much as sixteen hundred per wheel, and will be renewed after every race or lengthy test session. All told, your team will spend about twelve million dollars on its racing effort in a single year!

IndyCar Vs. Formula 1

In looking at IndyCars in comparison to Formula One racers, there are numerous differences that separate the two. First and foremost, your IndyCar is over 400 lbs. heavier than its Formula One counterpart. While Formula One racecars are normally aspirated, that is, they combine air with fuel inside the engine using conventional methods, your IndyCar is turbocharged, allowing its engine to compress the air/fuel mixture to fit more into the cylinders. This translates into a dramatically higher amount of available horsepower than without the turbo. Formula One cars burn a variety of exotic fuel substances, while IndyCars are run strictly with methanol.

Then there are the racing demands- IndyCars are raced on virtually every available venue, from superspeedways, to short ovals, to road courses, to temporary street circuits. IndyCars are regulated in much stricter fashion than Formula One teams, because IndyCars race with such diversity. The higher overall speeds, coupled with various challenges, have forced the IndyCar teams to take a hard look at crash-worthiness.

The IndyCar must withstand higher impacts than a Formula One car, and this fact accounts largely for the heavier weight onboard. Much of the added bulk that IndyCars carry can be attributed to stern safety measures employed by CART (the organization which governs IndyCar racing).

Finally, IndyCars are subjected to the severest wind tunnel tests available. Engineers gather information from these inspections, and use it to create some of the most advanced aerodynamic designs possible. Miniature wind tunnel models (often produced at a cost that exceeds that of the actual car) are built to scale, allowing the teams to be more resourceful in their use of space for such purposes. The use of models also allows test engineers to simulate turbulence as it flows about greater distances from the racecar, in order to learn just how far reaching the wind's effects really are.

Chassis & Engine Selections

When you choose **Cars** from the **Main Menu**, you are presented with an IndyCar driver's dream come true: an opportunity to build your IndyCar with the chassis/engine combination of your choice. Study the information below to determine which components are right for you. Note that chassis designs create unique aerodynamics due to differences in body mass. Engines vary mainly in the areas of horsepower and torque curves.

Chassis	Characteristics
Lola '92	Good, basic IndyCar chassis.
Lola '93	Somewhat lighter than the '92 version, less drag, better downforce/drag ratio.
Penske '92	Similar to '92 Lola.
Penske '93	Lighter than the '93 Lola, slightly more drag.
Galmer	Better overall aerodynamics than its '92 rivals, but slightly heavier.
RH001	Less drag but more weight than its '93 rivals, downforce/drag not as good.

Engine	Characteristics
Coswroth XB Peak Revs: 12, 500	Compact design, slightly more peak power than the Chevy/C, but less mid-range torque.
Chevy/A Peak Revs: 12, 300	The original Chevy Indy engine, proven reliability with good power.
Chevy/B Peak Revs: 12, 500	An update to the successful "A" version, offering slightly more power.
Chevy/C Peak Revs: 12, 500	Re-engineered to offer more power and mid-range torque than the "B" version, while sporting a smaller, lighter package.
Buick Peak Revs: 9,000	More peak power than the other engines (with higher allowed turbo boost). Much less forgiving of abuse.

Note: The Buick engine will not tolerate the same gear ratios the other engines use. The Penske '93 and Chevy/C chassis/engine combination is the default car.

Program File Notes

As you become familiar with IndyCar Racing, you may wish to copy or modify some of the files the program uses, in order to further enhance game play. For instance, you may wish to change the driver's names and hometowns that are displayed in the game. The following information shows you where some of these files are stored; however, you should not alter any of these files unless you are an experienced DOS user.

Driver Information is stored in the **CARS\CARS93** subdirectory, in the file named **DRIVERS.TXT**. This file contains the drivers names, nicknames and hometowns.

Race Results are stored after you complete a race and leave the race track, in the main directory. The files is called **RESULTS.TXT** and contains the same information that is displayed on the final standings screen. You may want to rename this file or print a copy of its contents.

Season Standings are saved only if you are competing in a Championship Season, as you complete races and leave the racetrack. The file is in the main directory and is called **SEASON.TXT**. You may also want to rename or print this file.

Car Settings are stored in each track's directory. The settings that are available from the garage menu all have the extension **.STG**. Each track has **EASY, FAST** and **ACE** settings pre-defined. The most recent settings used are stored in a file called **DEFAULT.ST1**. You may wish to use **DOS** commands to copy settings from one track to another, though you should be very familiar with **DOS**.

SECTION 10: CONTACTING SIERRA FOR FURTHER ASSISTANCE

Sierra On-Line has a full library of help documents available electronically. You can download them from the following sources:

- America On-Line: Use keyword SIERRA and choose "Software Libraries", then "Troubleshooting Guides & FAQ's"
- CompuServe: Use go SIERRA, choose "The Sierra On-Line Forum", then search the "Help Documents" library.
- Go to our home page on the World Wide Web at http://www.sierra.com and follow the on-screen information.

Additionally, you can get documents via our automated faxback service. Call (206) 644-4343, choose to use the automated technical support system and follow the voice instructions provided. You will be faxed a catalog of all of the documents that we have to offer and you will then be able to get the documents you need. If you prefer, you can also fax us at (206) 644-7697 with your document request.

If you prefer to get assistance from a technician, Sierra Technical Support will be happy to assist you. All of the online services listed above are staffed by Sierra technicians. Additionally, you can send e-mail to support@sierra.com.

In case you wish to contact us via fax or U.S. mail. Our fax number is (206) 644-7697 and our mailing address is:

Sierra On-Line Technical Support
PO Box 85006
Bellevue, WA 98015-8506

For phone assistance, you can reach Sierra Technical Support at (206) 644-4343 between 8:00 am and 4:45 pm, Monday through Friday. Please try to be at your system or have a copy of a Microsoft Diagnostics (MSD) report from it when you call.

If you are in Europe, please contact our office in England. The Customer Service number is (44) 1734-303171, between 9:00 am and 5:00 pm, Monday through Friday. The BBS number is (44) 1734-304227 and the fax number is (44) 1734-303201. Customer Service can also be reached at the following address:

Sierra On-Line Limited
4 Brewery Court
The Old Brewery
Theale, Reading, Berkshire
RG7 5AJ UNITED KINGDOM

Thanks for choosing Sierra!