"Four-Wheel Drift"

By STEVE SMITH

A Car Guy's Guide to Papyrus' "Grand Prix Legends"

"There is no terrible way to win. There is only winning."

-driver Jean-Paul Sarti (Yves Montand) in "Grand Prix" (MGM, 1967)

About the Author

Steve Smith has been a "car guy" since he was knee-high to a hubcap. He was the editor of Car and Driver in the 1960s, Motor Trend in the 1970s, and PC Computing in the 1980s. He's driven everything from the Oscar Mayer Wienermobile to the Rover Le Mans turbine. He's currently restoring a VW "Thing" for his son, Trade. "Four-Wheel Drift" is his third book.

Dedication & Thanks

This book is dedicated to the unsung heroes/heroine of the beta test team, who contributed so much more to this book than I ever could have discovered on my own; among them Doug Arnao, Alison Hine, Joachim Trensz, and John Wallace.

I also have to thank Papyrus' Mike Lescault for holding my hand through this sometimes painful process; Matt Sentell, "Grand Prix Legends"' lead designer; and Dave Kaemmer, the godfather of auto-racing simulations, who still does it better than anybody else.

-Steve Smith
Wyoming, NY
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Chapter One: The End of Two Eras

Papyrus' "Grand Prix Legends" is hardly the first computer simulation to masquerade as a Time Machine-retail shelves groan under the weight of air-combat sims that promise to take you back to World War I, WW II, Korea, Vietnam, or the Gulf War-but "Grand Prix Legends" is the first motor-sports sim I know of which will allow you to revisit auto racing's illustrious past.

The choice of 1967 as the year that "Grand Prix Legends" recreates, though, has caused some head-scratching. Why 1967? If the game were set some ten years earlier, the player would be smack-dab in the middle of Grand Prix racing's rear-engined "revolution," with parvenus like Britain's plucky little Cooper Car Company. Or move the game's time-frame forward ten years and you'd be in on the ground floor of the turbocharging craze, when drivers had virtually unlimited horsepower available at the touch of a button.

What's so special about 1967?

Ask the guys at Papyrus who had to wrestle with this decision and you'll get two different answers. The romantics will sigh and tell you that 1967 was the last year before advertisements were allowed to sully the flanks of Grand Prix cars (which until then had been painted in pristine national liveries: green for Britain, red for Italy, etc.); that is, the last year before Grand Prix racing "went commercial."

The realists will roll their eyes and tell you the true significance of 1967 was that it was the last year before "wings," "spoilers," "foils," "fences," "air dams," "tunnels," "chin whiskers," "lips," and other aerodynamic accoutrements were added to the cars, and thus, the last year that the driver was doing more to hold the car on the road than the wind disturbed by its passage.

The introduction of "aero" forever changed the way the car felt to the driver, and Papyrus, which had already aced modern cars in a suite of best-selling racing simulations, wanted to explore the time when raw driving talent trumped mere technical embellishments.

The result is, of course, "Grand Prix Legends," and Papyrus has once more outdone itself and raised the bar for its competitors to hurdle. The problem is that driving "Grand Prix Legends" is so realistic that these by-now "vintage" racing cars really do feel the way Grand Prix cars did thirty years ago ... before aero ... which is to say, decidedly skittish. In those days, nobody stepped into a 400-horsepower, 1200-lb. car on rock-hard, bias-ply,

treaded tires and went fast right out of the box ... and neither will you. Without aero as a driving "aid," you'll be struggling just to get the power down, even at speeds approaching 200 mph. Without aero, the car won't be held in the turns by more "downforce" than the total mass of the car. Without aero, you can't smear on the brakes with impunity. Without aero, you can't make the cars handle just by dialing in more wing. These unadorned old crates demand respect, and if they don't get it, they will bite you.

What you need is Race Driving 101, and that's exactly why Papyrus asked me to write this book. "Four-Wheel Drift" is a hands-on, step-by-step guide to help you through the discouraging part of the learning curve, and stay with you until you're experienced enough to enjoy the real challenge of "Grand Prix Legends," which is going for the World Drivers Championship, your chance to rewrite the 1967 Grand Prix season.

But first thing's first: a little history lesson, various hardware ruminations, some "chalk talk," and maybe a few avuncular words on why you're better off driving in your socks than a pair of $195 Sporting World driving mocs.

Grand Prix Racing's "Return to Power"

As years go, 1967 was a pretty good one for auto racing. Versatile Mario Andretti (he would win the World Drivers Championship in 1978) took the checkered flag in the Daytona 500. Anthony Joseph Foyt won the Indianapolis 500 for the third time after a two-bit part snapped on arch-rival Parnelli Jones' turbine car, "Silent Sam," with three laps to go. The irrepressible A.J. also won at Le Mans, co-driving a huge Ford GT Prototype with Dan Gurney in the world-famous 24-hour sports car enduro. And Gurney himself won the Belgian Grand Prix at Spa-Francorchamps driving his own Eagle-Weslake, the first time a Yank in a Yank car had won a Grande Epreuve since Jimmy Murphy won the French GP in a Duesenberg way back in 1921.

Nineteen-sixty-seven was also the second year of a new formula for Grand Prix cars which was to last another ten years before turbocharging overturned the apple cart. Under the rules that came into effect in 1966, engines were allowed up to three liters (183 cubic inches) displacement, unblown; that is, normally aspirated. The formula which had immediately preceded it had limited engines to a tiny 1.5 liters, and thus the 3-liter formula was widely heralded as Grand Prix racing's "Return to Power." In truth, many of the sport's leading engine suppliers were caught out by the sudden doubling of engine displacement. Australian Jack Brabham cobbled up a simple, sturdy car for the new formula, mating a lightweight Formula 2 chassis with a homebrew racing engine based on the aluminum-block Oldsmobile F-85 V-8, and won the 1966 World Championship with the rig.

By the first race of the 1967 season (the South African GP on January 2), many of the teams still didn't have their acts together. A local hero almost won the race in an ancient Cooper-Climax, but ran out of gas, handing the win to Mexico's Pedro Rodriguez in a

Bruce McLaren leads Jochen Rindt and Dan Gurney as the trio drifts hard around one of Kyalami's fast bends.

Maserati-powered Cooper. British engine-builder Coventry-Climax had been one of the mainstays of the old 1.5-liter formula, but had withdrawn from racing at the dawn of the 3-liter era, forcing Cooper, along with most other British teams (save BRM, which built their own engines) to look elsewhere for power. Cooper, by then owned by Britain's Maserati concessionaires, had to settle for an engine which the Italian manufacturer had first developed a dozen years earlier. It was pretty much the last gasp for both Cooper and Maserati in Grand Prix racing.

Dan Gurney had hired ex-BRM engineer Harry Weslake to design a V-12 for an Eagle chassis that Gurney also intended to drive in the Indy 500, but when the new engine still wasn't ready, Gurney likewise filled in with an older Coventry-Climax. Some privateers tried to make do with old 1.5-liter BRM V-8s punched out to around 2 liters, but BRM (British Racing Motors) itself, which had designed some of the most elegant engines of the earlier formula, and which would go on to fame and fortune with a lovely new V-12 of their own, made the mistake of taking two flat-8 ("boxer") 1.5-liter motors and pancaking them atop one another to make a Brobdingnagian H-16. This contraption not only looked ungainly (and was the cause of the car being several hundred pounds overweight), it also had a sky-high center of gravity that made every car in which it was installed handle like a city bus.

Ford's Best "Better Idea"

Over at Cosworth Engineering, they tried pretty much the same idea ... but with excellent results. British engine-genius Keith Duckworth (the "-worth" of Cosworth; aerodynamicist Mike Costin being the "Cos-") took two Ford-based Formula 2 four-bangers and joined them together at the crankcase to make a V-8 that went on to win more Grands Prix than any other powerplant in history: 155. But the DFV ("Double Four-Valve) wasn't ready until the Dutch GP in June. Meanwhile, Brabham's teammate, New Zealander Denis ("Denny") Hulme had already won the GP of Monte Carlo in May ... and would go on to win the 1967 World Drivers Championship, and the Constructors Championship for his boss, Jack Brabham.

The new Cosworth (paid for by Ford ... it cost a mere hundred-thousand quid, less than it would have cost to develop a new first gear for an economy car), bolted into the equally new and untried Lotus 49 chassis, would go on to win its first race-the GP of Holland, at Zandvoort, with former World Champion Jim Clark driving-and dominate the '67 season

(and beyond), usually sitting on the pole, setting the fastest lap, and winning the race. When the car didn't break, that is ... and during 1967, it broke often.

When Is a Grand Prix a Grande Epreuve?

There were eight more races that counted toward the World Championship that year, and the points battle see-sawed back and forth between Clark's Lotus and the two Brabhams. Clark won in Holland and Great Britain, and Brabham in France and Canada, before the GP "circus" arrived at Monza for the 1967 Italian GP, arguably one of the greatest races in auto racing history (and is described as such in Alan Henry's authoritative "Fifty Famous Motor Races").

The '67 Italian GP was also Scotsman Jim Clark's greatest race, even though he didn't win. From the pole, Clark quickly took command and zoomed ineluctably away from the field, wagging a scolding finger as he passed Brabham, who'd jumped the start. But on lap 14 (of 68), Clark limped into the Lotus pit with a cut tire. By the time the flat was fixed, he'd gone a lap down. Driving like a man possessed-his usual driving style was unflappable-Clark hunted down the leaders, passed them to unlap himself, then passed the entire field again to regain the lead. But then, on the final lap, his Lotus coughed and died, and Clark coasted helplessly toward the finish line, pummeling the steering wheel in frustration. In a flash, Britain's John Surtees, in a Honda, shot past, then Brabham, in a duel of their own. Surtees took the checkered flag (the first and last win for Honda under the 3-liter formula), with Brabham close behind. Clark rolled to a stop just beyond the finish line, a thimble's worth of gasoline away from what should have been his greatest triumph.

The great Jim Clark and his Lotus storm around the 'Ring' in purposeful fashion.

While the "wee Scot" (Clark) had been clawing his way back from 15th place (of 18), the front runners hadn't exactly been hanging about-there were a dozen lead changes during the race, something as rare then as it is now. The season resumed, and Clark won the next three GPs in a row (the U.S. and Mexican events in '67, and the South African season opener in '68) before he died in a mysterious crash at Hockenheim, then a bush-league track, in an unimportant Formula 2 event.

Even though the 3-liter formula still had a long way to go, 1967 truly was the end of an era.

Recreating The Way It Was

"Grand Prix Legends" is a true-to-life simulation of the 1967 World Championship Season, with only a couple of exceptions, noted below. As a player (you join a team as an added driver, as opposed to replacing an existing one), you can enter any of the 11 races that year, individually, or-in the Championship mode-in the order they were run; in any of the seven cars modeled in the game: the fast-if-fragile Lotus-Ford V-8; the steady, reliable Brabham-Repco V-8; Gurney's drop-dead bodacious Eagle-Weslake V-12; the clumsy, powerful BRM H-16; the (fantasy) Murasama with its Godzilla of a V-12; and the (fantasy) Coventry V-12, another V-12, but less powerful than the others.

Among the major teams, only Honda and Cooper are missing (unwilling or unable to grant licensing rights). Among the drivers, you can go wheel-to-wheel with the greats of the era: two-time ('63 and '65) World Champion Clark and his teammate Graham Hill (who was himself Champion in '62 and '68, and father of the 1996 World Champion, Damon Hill); Gurney and his sometime teammate Bruce McLaren ('69 Can-Am Champion); World Champions Brabham and teammate Denny Hulme; Cooper drivers Rodriguez and his teammate, 1970 World Champion Jochen Rindt (they drive the Coventry in the game); and 1964 World Champion Surtees (who drives the lone Murasama in the game), and other lesser lights.

With the attractive Monte Carlo skyline fading in the distance, Bruce McLaren streaks toward the Casino in his Eagle. Though better known for his Can-Am exploits and design work, McLaren had a quite formidable career as a Grand Prix driver.

Among the race tracks, the only absentee is the infamous "Bugatti" layout at Le Mans, site of the real 1967 French GP. It used only the front straight and Dunlop bridge of the famous Sarthe circuit-the rest of it was laid out in a parking lot behind the pits-and proved so unpopular that the GP tour never stopped there again. Papyrus wisely chose to substitute the lovely natural-terrain road circuit at Rouen-les-Essarts in Normandy, where the French GPs of '52, '57, '62 (Porsche's only GP win; Gurney up), '64, and '68 were actually staged. This sylvan venue is typical of the open-road layouts of its day, and thus totally in keeping with the spirit of the times.

Now Drive This

The other 10 tracks in "Legends" are meticulous recreations of the originals, from the mighty 14-mile, 174-turn Nürburgring in Germany (surely the most difficult race track, anywhere, ever) to the familiar contours of Watkins Glen in upstate New York. In between: the big-sky veldt of Kyalami in South Africa (a variation of which is still in use today); the hairpins, switchbacks, and unique tunnel of round-the-houses Monte Carlo (ditto); the minimum-security-prison-look of Mexico City's mile-high Autodromo; the long, willowy stretches of two-lane country road at Spa-Francorchamps in Belgium (its Eau Rouge corner is considered one of the most fearsome in road racing); the wild roller-coaster rides of Eastern Canada's Mosport and Zandvoort-by-the-sea in Holland; and the fast, flat tracks at Silverstone in England (a WW II airbase perimeter road) and at Monza in Italy (probably the fastest purpose-built road circuit in the world in its configuration in "Grand Prix Legends").

Is this a great premise for a game, or what?

Putting the "I" Back in "AI"

You can also book any of these tracks for solo practice sessions (called Training sessions in the game) and learn your trade in splendid isolation. If you're struggling with the learning curve, there are also options to reduce your car's power, to prevent its brakes from locking, to prevent its wheels from spinning, and to shift the gears automatically. Once you've tested your mettle against the so-called "AI" (for Artificial Intelligence, or computer-controlled) cars, you can race real, live human opponents in the Multiplayer mode (connecting two or more computers direct, via modem, over a LAN, and on the Internet), or a mixture of AI cars and flesh-and-blood drivers.

You can also choose from three levels of AI opponents at three different race-lengths, from short Novice events to full-blown Grands Prix (the races that year ranged from 195 miles at Monte Carlo to 245 miles at the Glen). Unlike modern GP races, there are no pit stops for anything but serving penalty time for infractions of the rules. The cars carried enough fuel to go non-stop, and the heavily-treaded tires often lasted several races.

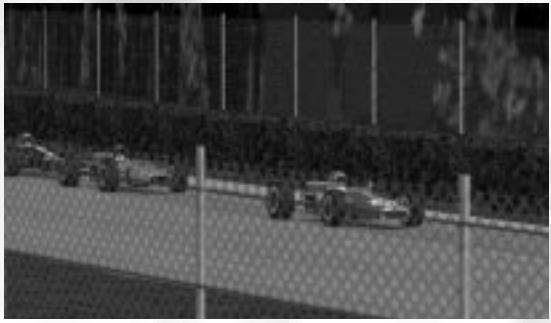
The degree of realism in "Grand Prix Legends" is startling even to seasoned sim racers. Not only do the cars handle like the real thing, the cars also crash realistically (shedding wheels and shards of fiberglass, smoking, burning, even launching dramatically skyward if you hit anything shaped like a ramp). Not only does the player see a pair of gloved hands sawing away at the on-screen steering wheel and working the stubby gearshift, your opponents in the Multiplayer mode can also see your movements inside the car. In real life, if a driver was in trouble (a spin, a cut tire, an engine blow-up), he would raise his hand in the air as a signal to those behind him. You can do the

same in "Legends," possibly preventing a human competitor from slamming into you from behind.

The Laws of Physics: Strictly Enforced

Everything that moves in "GPL" is subject to the real-world laws of physics. Each tire has its own physics model. Each suspension part may be seen moving realistically up and down. If you stomp on the brakes, the nose of the car dives. Put the pedal to the metal and the rear end squats. Bang into a curb and the steering wheel visibly shudders. Even the rotational inertia of the engine is modeled: push in the clutch (yes, Virginia, there is a clutch, although its use is optional) and blip the throttle, and sure enough, the chassis rocks in the opposite direction. Let the clutch out in neutral, and, mirabile dictu!, the idle speed drops slightly from all that rotating mass inside the gearbox. If the devil is in the details, Dave Kaemmer, Papyrus' lead programmer, must have two horns, a tail, and a really wicked grin.

For budding race engineers, there are more chassis settings than you could shake a slide-rule (remember them?) at. To begin with, there are the car choices themselves. The player can take advantage of something no real-world 1967 driver could do: you can test-drive each of the cars and choose the one you like best. And then take it to the track and take as much time as you want "tuning" it to suit you. From the Car Setup menu, the player can fiddle with everything from the suspension to the steering to the drivetrain-probably in more ways than the teams' mechanics could in 1967. (When Papyrus proudly demonstrated all the possible chassis adjustments to the Brabham's original designer, Ron Tauranac, he just laughed. "In those days," said the wiz from Oz, "we just unloaded the car, swapped in gears suitable for the track, and told the driver to compensate for everything else.") Still, it's nice to know that if you tweak the settings in the direction you might be inclined to in real life, the virtual race car will respond in the same way as the real thing...and by and large to the same degree.



Jack Brabham rockets through the Curva Grande at Monza. Note the level of detail, including the shrubbery and chain-link fence.

On the track, "GPL's" computer graphics are no less impressive. Trackside details include billboards with authentic period signage, architecturally-correct buildings, steel guardrails, sand

traps, haybales, fences, curbing, telephone poles (with wires), animated course workers, spectators, grandstands, beautifully rendered skies, accurate altitude changes, even intersections (although one trip up an escape road will demonstrate that these roads don't lead anywhere-you run into an invisible "wall"). If you turn it on (from the Options menu), the racing "groove" appears-a gray-ish shmear of tire marks, darker where the cars brake the most heavily, and fading away on the straights.

The Gameplay's The Thing

There isn't much gameplay, per se, in the solo Training sessions, but show up for a race weekend and you'll be able to run the full gamut of activities: timed practice on Friday and Saturday (there were no separate qualifying sessions; your best lap time of the two-day's sessions determined your grid position). On Sunday, as the cars line up on the grid, you'll sweat through an adrenaline-raising countdown, then wait an additional, agonizing few seconds for the green flag to drop as the race finally gets under way. Just like the real thing, the cars around you rev their engines to a fever pitch just before the start, then howl off the line in a cacaphony of a hundred cylinders. (Jump the start and you'll be called into the pits for a penalty stop n' go. Ignore the black flag and you'll be disqualified.)

While the practice sessions are devoted to reckless speed, the races are exercises in calculated risk. If you downshift too soon, you can blow your engine to smithereens. If you lock wheels with a competitor, it can put both of you out of the race. If you crash, you may damage your car beyond repair. If you miscalculate the amount of fuel you need to finish, you may run dry within sight of the checkered flag. If you go off the track, you can't just hit a couple of keys and start again, you have to go back to square one and start the weekend all over again. Or do it the way the real drivers do: ease the car back on the pavement and try to catch up with the field again.

Winning Isn't Everything. Yeah, Right.

If you can avoid the physical pitfalls, there are still plenty of mental challenges between you and victory lane. Consider, for example, the AI in every other auto racing game, including Papyrus' previous efforts: the cars drone around the track like robots...because they are robots! Perfectly behaved (unlike their human counterparts), they brake at the same point every lap, always take the ideal line through every corner, and never make a mistake...until the race either ends or a random-number-seed algorithm causes them to drop out...or until they crash out, usually in an incident triggered by the player.

In "Grand Prix Legends," the AI drivers act like, well, human beings. Sometimes they make mistakes. Sometimes they're on top of their game. Sometimes they make Herculean efforts only to have their cars let them down. Some days they're uncat-

chable. Other days they should have stayed in bed. And that's just when they're racing the tracks and each other. When a computer-driven car comes up behind you and you try to prevent it from passing you, the AI car won't simply bull its way past; it will tuck in behind you for a lap or more if necessary, analyzing the way you drive. When the AI determines where on the track you're the slowest, that's where your opponent will make his move. In the Multiplayer mode, running against a mix of human and computer drivers, I doubt that you'll be able to tell which is which. The AI is that good.

It isn't just me saying this. Computer Gaming World Editor-in-Chief Johnny Wilson took one look at a preview of "Grand Prix Legends" and couldn't wait to gush to his readers that this sim has, "better graphics, more accurate physics, and more satisfying gameplay than any racing game to date."

So...let's play.

In 1967, Grand Prix races began from a "standing start" just as they do today. Here, the grid at Mexico is poised in anticipation as the starter prepares to drop the green flag.

Chapter Two: Hardware Requirements, Thick and Thin

Before we go any further, let's make sure we're all playing from the same page of the hymnal, hardware-wise.

"Grand Prix Legends" is a serious sim, and serious sims demand serious hardware. The game will run okay if your computer meets the minimum hardware requirements stated on the box, but there's no such thing as too much hardware. If you want to get the most out of the game, you'll want more. Much more.

Let's start with the CPU (Central Processing Unit); the main chip. This is like a race car's engine, and all other factors being equal, you want as much horsepower as you can get. The so-called clock speed of the CPU is kind of like a horsepower rating, only it's measured in Megahertz (MHz), and more is definitely better.

This is just personal opinion, but I prefer CPUs made by the Intel Corporation. There are others which hold the promise of better performance, lower price, or both, but in my experience, Intel is the way to go, for speed and compatibility, if you can afford it. Intel has spent a bundle advertising the "Intel Inside" theme, but if you don't yet own a computer, I'd make sure the one you buy really does have an Intel inside (some unscrupulous computer salespersons will actually-horrors!-fib when it comes to clinching a sale).

There are three "lines" of Intel CPUs, the oldest of which is the Pentium, which started life as a 66-Mhz weakling, and finally topped out at well over 200 Mhz. Then came the Pentium II, which came out of the starting gate at well over 200 Mhz, and is now heading for the 500 Mhz stratosphere. Finally, there's the Celeron, a low-price, performance-limited CPU which has a singular advantage: it can be "souped up" by electronic hot-rodders to run almost as fast as a high-end Pentium II for a fraction of the cost, but unless you're intimate with terms like "mobo," "BIOS," "Slot 1," "PCI," "AGP," and "BX chipset," I wouldn't get under the hood. If you can already "bench race" with language like this, you probably already know what to do.

For the rest of us, the choice is between a Pentium and a Pentium II. The latter (PII) is the way to go ... if you can afford it. If you never want to do anything more than learn the tracks and set personal-best lap-times for each (these are called "Hot Laps" in the sim world), you can get by with a reasonably fast Pentium; a 200 Mhz or even a 166

Mhz. But when you get several AI cars on the track in addition to your own, your computer's performance will suffer. That is, the so-called "frame rate," which is the key to Sim Heaven (as I will explain), will drop like a rock.

Frame rate is measured in "fps" (frames-per-second), and it is the number of times per second that the computer can render a new picture (or "frame") on your monitor's screen. If your computer can't provide at least 15 fps, the on-screen motion will not be perceived as smooth, continuous action, but rather as a flickering series of still images, like an old-time movie. If it gets below about 5 fps, you can pick out individual images. How you perceive this stream of images is dependent on a phenomenon called the "persistence of vision," and it has to do with how quickly each image fades from your eye's retina. If each new image is displayed before the old one fades, your eye will not register the new image as a separate image, but as a continuation of the previous image, i.e., as motion. The threshold for when this phenomenon kicks in is about 15 fps, which is why movies (at 24 fps in the U.S.) and video (30 in the U.S.) look like animated scenes and not a high-speed slide show.

Unlike film or television, the frame rate for most computer games is not steady; it varies with the computer's work load. Unlike side-scrolling "console" games, the three-dimensional images in simulations like flight and driving games are extraordinarily complex. Not only does the CPU have to handle all the stuff you don't see (like calculating all the underlying physics in the game), it also has to draw up to a million individual "pixels" (picture elements) on your screen ... and then re-calculate and redraw everything all over again 1/30th of a second later.

Why Frame-Rate Matters

So what? So this: the better your frame-rate, the better your car control. Hypothetically, imagine driving the family car down the road with your eyes closed. Every once in a while, you open your eyes for a fraction of a second to see where you are and to make mid-course corrections. The further apart these brief glances are, the more likely you are to go off the road between peeks. Same deal with frame rate: the closer you can come to 30 fps (the human eye doesn't perceive much improvement above 30 fps), the more your hand-eye coordination will benefit from timely feedback.

The worst part is that your computer's frame rate suffers the most just when you need it the most: at the beginning of a race, where every car is within view and in motion. Frame rate also suffers when the computer has a lot of scenery to deal with. At Monaco, for example. It's not that the many buildings are moving; it's that they're moving relative to your in-cockpit view, the way the railroad station seems to be going backwards when the train starts to move. That is, relative movement is just as taxing as having 19 other cars lurch away from the starting line.

Fortunately, there is a way to take some of the graphics load off the CPU, so it can

concentrate on the kind of mathematical calculations it does best. So-called video "accelerators" or "3-D" cards can lighten the CPU's burden, often at less cost than upgrading the CPU itself. There are two kinds of accelerators: the kind that replace the video circuitry already in your computer, and add-on circuitry which aids and abets what you've already got under the hood. Some of the newer, under-$1000 home computers have cut costs by soldering the video circuitry to the motherboard, so it cannot be removed, replaced, or disabled. This is avoided by savvy gamers, because it locks you into something you cannot upgrade.

Acceleration of the 3-D Kind

"Grand Prix Legends" supports two (and only two) different hardware acceleration chips: those made by Rendition, and those made by 3Dfx Interactive. Papyrus is almost alone in its enthusiasm for Rendition's Verite-series chips (which now include the V2100 and the V2200); so few other software developers support it that it's hard to give an unqualified recommendation for the boards that use these chips, but they do have some compelling advantages. One, they're considerably cheaper than their counterparts from 3Dfx. Two, their performance at lower resolutions (800x600 and below) may often be better, particularly with Pentium (as opposed to Pentium II) systems. Three, I actually prefer the image the Verites produce (particularly the V2200); the 3Dfx image is so over-filtered that-to me-it looks blurry. And the colors of the 3Dfx look washed-out by comparison.

The best-known of the 3Dfx chips is the original Voodoo Graphics (and, more recently, the Voodoo2, neither of which is to be confused with the Voodoo Rush, which is a bowser). They are hugely popular because they are supported by more high-end software developers than any other. These Voodoo chips are used in so-called "pass-through" boards, which means you leave your current video circuitry in place, plug the Voodoo board into a spare PCI slot, and wire your video output into one connector on the Voodoo board, and your monitor to another; thus, a Voodoo can be made to work with even a soldered-in video chip.

By some stroke of incredible luck, you can use both boards in the same computer (if the video chip isn't soldered in place): a Verite as the primary video circuitry and a Voodoo as the secondary, giving you the best of both worlds. If you're rich as Croesus, you can even add a second Voodoo2 board, which will work in conjunction with the first to provide the ultimate in video performance.

However, most of us can't afford all this gear, and will have to choose one board or the other. As a rule of thumb (the first of many in this book), the Rendition boards will give a slower CPU a tremendous performance boost (as measured in fps), while the Voodoo boards are able to take full advantage of a faster CPU. Thus, players with a Pentium II of any speed would be well advised to add a Voodoo, regardless of their pri-

mary video circuitry, while owners of a 200-Mhz (or slower) Pentium should consider replacing their primary video circuitry with a Verite.

There is one simple test that will show you whether or not you've got enough moxie to run "GPL" without adding more silicon horsepower: wend your way through the menus until you're actually sitting in the car (you don't have to be in motion; just sitting in the cockpit). You'll see a pair of gloved hands gripping a steering wheel. Using your controller (I'll get to what kind of controller-wheel and pedals, or a joystick-next), rack your controller left and right, quickly. If the on-screen steering wheel motion noticeably lags your controller's motion, you need a faster CPU or a hotter video setup. Or both.

Turn Down the Details: *There are several ways to improve the frame rate without resorting to throwing money at hardware solutions ... if you're willing to live with less. I've already mentioned that frame rate suffers when there's more than one car on the track. In a race, you can select from 5 to 19 opponents. You can also reduce the number of sounds heard, from the Options menu. You can reduce the screen resolution (anything over 800x600 is overkill, if you ask me, although anything less than 640x480 looks pretty chunky). You can reduce effects like sparks, smoke, fire, skid marks, and "specular highlights" from the Options menu. And how far ahead the computer renders details. For reasons I will explain, I don't think you should eliminate the "groove" drawn on the track. But you can reduce things like horizons and crowds (and their textures) or eliminate altogether some of the details shown in the rear-view mirrors (which amount to two separate, extra screens the computer has to draw in addition to the main view). You can make the hands on the steering wheel go away ... and even the steering wheel itself. With everything reduced to a bare minimum, "GPL" will indeed run smoothly on a 133- or 166-Mhz Pentium with software-only acceleration ... but it won't look very impressive. And you won't be able to race with anybody without the frame rate heading for the cellar.*

Everything Under Control

The only other important hardware issue is what you use to control the car, and how it's hooked up. Starting with the easiest, almost every computer nowadays comes equipped with a sound card, and in addition to its **Line Out** or **Speaker jacks**, almost every sound card also has a 15-pin, D-shaped connector for a built-in "game port," which is where you plug in a joystick or steering wheel and pedals. By and large, there is nothing wrong with the game ports built into sound ports-they're more than adequate for flight simulations, arcade games, and other racing sims-but "Grand Prix Legends" demands more smoothness and precision than any other non-medical software I know of. When you're warped into a 4-wheel drift inches away from a steel guard rail, or tailgating another car at Monza at 190 mph, you don't want the car to be jumping around, you want it planted on the track like a limpet.

Then there are the controllers (or input devices) themselves. For most other kinds of computer gaming, a simple (or fancy) joystick will do nicely. My career in computer games started with flight sims, and I used the classic 2-axis, 2-button CH Products FlightStick: fore-and-aft for pitch, side-to-side for roll, and a combination of the two for yaw. When flight sims added support for throttle and rudder controls, I added a second FlightStick for my left hand, with the X-axis (left-and-right) for rudder control, and the Y-axis (fore-and-aft) for the throttle, and plugged it into the port's second joystick connector (each game port in those days supported a second stick).

When I got interested in driving simulations, this setup worked surprisingly well: steering with my right hand (the X-axis of Joystick 1), forward with my left hand for the throttle (the Y-axis of Joystick 2), and backward with my left hand for the brakes (again the Y-axis of J2). What tipped me over was peer pressure: my racing buddies would come over and look at my odd hand movements and ask if I was playing the Theramin or what. So I caved in and bought a proper steering wheel and foot pedals for gas and brakes, which felt unnatural at first, but at least looked like I was driving a car, not docking a space station. Only one problem: you can't fly a plane with a steering wheel and foot pedals (unless the wheel is attached to a push-pull yoke, for pitch control). So I gave up flight sims. Hell, I was already more of a racer anyway.

Joysticks vs. Wheel & Pedals

What should you do? If "GPL" is your first auto racing sim, no question (as Mario would say), you should get a good steering-wheel-and-pedals setup. It looks right, it feels right, and you won't have to take any guff from your racing compadres. If you're a Sega-generation arcade racer, be warned: a single joystick won't cut it with a game as demanding as "GPL" (for starters, you're likely to blow an engine because it's almost impossible to "burp" the throttle to avoid the dire consequences of "speedshifting"). The guys who developed the game at Papyrus are addicted to a joystick (for fast steering response) and foot pedals ... and they have the lap records to prove it works. If you're a grizzled flight-sim veteran, you might want to try my old two-stick setup (although many sim pilots are habituated to left-hand slide throttles, which simply won't work with driving sims).

A list of controllers is listed at the back of the book in the chapter on "Resources."

What's Your Position?

A word or two about your driving position. To me, the absolute worst thing about any controller configuration that includes steering with a joystick is that after about half an hour, your right shoulder will feel like it's been in a car crash ... and if you're ever going to get into full-length races, you're going to need an ambulance after an hour or two

(the shortest race in 1967 was Belgium at 1:40:49; the longest was Canada at 2:40:40). Using a wheel and pedals spreads the load (and the pain), so I'd recommend them for that reason alone. If you accept this premise, then it follows that you don't want to be sitting bolt upright in front of your computer, as if you were keyboarding The Great American Program in C++; you want to replicate, as closely as practicable-a real-life driving position. Well, maybe not too closely: a true "laydown" driving position will put a tremendous strain on your neck muscles (even without any lateral "G" forces), trying to tilt your head forward ... unless you mount your monitor high on the wall, like watching TV in a hospital bed. But you do want to be reclined at a comfortable angle, with the wheel far enough away that your arms are almost straight ahead (but not so far away that your elbows lock; your hands will get numb), and your feet well in front of you, not hanging down from the seat, and the pedals more inclined toward the vertical, like a racing car, than the horizontal, like a step-van.

There is a wonderful gizmo on the market (or you can build one like it yourself, if you're handy) called the ThunderSeat, which is basically a form-fitting race-car seat, mounted on a plinth (base) with a self-powered subwoofer (bass loudspeaker) underneath that you hook up to your audio gear. Although it's intended for flight sims (where the hum of an A-10 Warthog's 40mm depleted-uranium cannonfire will give you quite a buzz), it works great in "GPL." You can really feel it when you put a wheel in the dirt, run over the "rumble strips" (curbing), or smite the scenery. You can also get two panniers (side consoles) that sit alongside the seat, at exactly the right height to mount a HOTAS (Hands On Throttle And Stick in mil-speak) setup for flight sims, or a pair of plain-jane sticks for flying and driving. Or you can mount your steering wheel at the right distance to emulate the look and feel of a real racing car.

The ThunderSeat is likewise in the back of the book in the "Resources" chapter.

See Me, Feel Me, Hear Me

What's left? Sight and sound. Whatever computer monitor you've already got will be fine ... as long as it can support the maximum "refresh rate" your video card kicks out. Refresh rate sounds like frame rate, but it's not; it's a steady frequency-usually no slower than about 60 Hz (cycles per second), or about double your frame rate-that determines how often the picture tube (or LCD, if you're foolish enough to be trying to play "Legends" on a laptop) redraws the picture being displayed. That is, if you're getting a steady frame rate of 30 fps, displayed on a monitor running at a 60-Hz refresh rate, the video circuitry will throw a new image up on the screen twice before replacing it with a new frame. If the refresh rate is 90 Hz, each frame will be displayed three times, etc. Anything much below 60 Hz will cause eyestrain (from an almost imperceptible flickering, like a fluorescent light). Still images will "dance" slightly. Anything above 72 Hz will look rock solid. Modern monitors can display high-res pictures at very high refresh rates; a good one can display 1024x768 pixels at 72 Hz or better, which is ideal for "GPL."

The size of the monitor should be proportionate to the distance from your eye to the screen. A small (15-inch) monitor has to be right in your face to give you a realistic field of view; so close, in fact, that you will get eye strain from focusing on something too close. A large (21-inch) monitor has to be too far away to reach (you'd have to lean forward to adjust the controls), or it will seem overwhelming. A 17-inch monitor about two-and-a-half feet away or a 19-inch monitor about three feet away is ideal. I'm not going to make any brand recommendations for monitors because they're an intensely personal choice, but I'd read the computer-magazine reviews very carefully before buying one. Ditto speaker choices, although they're somewhat less subjective.

A pair of speakers should be mounted on either side of the monitor, angled toward the player's head. There is no true "surround sound" in "Grand Prix Legends," much less anything like a fifth (center) channel, so you don't want to get the speakers too far apart. On the other hand, the stereo effect (or "sound stage") in "GPL" is good enough that you can glean useful information about where your nearest competitors are, so you don't want the speakers too close together, either. Experimentation will quickly determine the best sound "spread."

Hardware Note: *The second-generation of PCI sound cards is cheap and cheery ... and you should see a small lift in frame rate. Creative Labs Sound Blaster Live card seems promising, although I didn't get a chance to try it. If only it had LINE OUT.*

Software Note: *The latest versions of Windows have a little check-box buried somewhere in the Multimedia controls that "enhances" 3-D sound if you enable it. Even though "GPL" doesn't support "positional audio," when I checked the box, it made the sound bigger, richer, fuller.*

Again, if you don't mind the hoots and catcalls of your peers, you can't do better than a good pair of headphones, although there is probably nothing more ridiculous-looking than somebody who thinks he or she is shifting a race-car engine at 10,500 rpm when they're sitting in an utterly silent room.

And about those $195 driving shoes. Lose 'em. Sim racing is an indoor sport, and you'll need all the sensitivity-not to mention comfort-you can muster, so treat your feet to a nice pair of $6 rag wool socks from L.L. Bean, and save the blue suede for a steering wheel cover.

Are you ready to race?

Chapter Three: Race Driving 101

Meet Master Sergeant Doug Arnao, your D.I. (Drill Instructor, or Driving Instructor, if you prefer) here at Race Driving 101, our virtual competition-driving boot camp. In real life, Sgt. Arnao is a race-driving "professor" for several car clubs, and a former SCCA National Champion, driving a wicked tube-frame Porsche 914-6 (in the quick-twitch Solo class; the real world's equivalent of sim racing's Hot Lap specialists). Doug's taught me everything I know about how to drive the cars in "Grand Prix Legends;" I only hope I can adequately explicate the teachings from the master to you wannabes. Gimme a 1:06, Maggot!

We're going to be conducting this part of the school at Watkins Glen, a 2.35-mile race track draped around a picturesque hillside in upstate New York's Finger Lakes region, and the site of the United States Grand Prix from 1961 to 1980. The event was usually the first cold, wet weekend in October. The '67 race was warm and dry, with riots of fall colors and colorful race fans. As configured in "Legends," the Glen was the fastest race circuit in the U.S. at that time, with average speeds of over 130 mph.

Why Watkins Glen for our driving school? One, the Glen has several advantages for newbies, not the least of which is that it's the track that most people who are the most interested in "Grand Prix Legends" are already familiar with ... because it's the track featured in the widely (and freely) distributed demo of the game. Two, although it's deceptively simple, Watkins Glen has a challenging mix of features found at many other tracks: a dizzying series of switchbacks (the Esses); a couple of fast, sweeping bends; one really slow hairpin (the Ninety); elevation and camber changes (the road surface is quite high-crowned); and some "high pucker-factor" braking zones, including a doozy where you can't see what you're braking for until you're already on the binders. Three, it's short enough to commit the basic layout to memory ... which isn't the same thing as easy: Spa is easy (most of it is straight), but it's eight miles around, and laps seem to go on forever. A good lap at the Glen takes just over a minute.

And one intensely personal reason: Watkins Glen is one of the few GP circuits I've actually driven ... in the era being simulated in "GPL." Monza is actually a far easier track to master (it's a lot more straightforward than the Glen), but all I know about Monza is what I saw in film director John Frankenheimer's paean to the three-liter for-

mula, "Grand Prix." Huschke von Hanstein, then Porsche's genial Rennleiter, once drove me around the Nürburgring in his Carrera coupe during practice for the 1000 K's, explaining the turns with his hands like a fighter pilot, while looking for a missing team car ("Look for holes in the trees," he told me). I was white with fear. (Everything you need to know about the Ring you can see for yourself in the documentary "In Car 956" check out the "Resources" chapter at the end of the book.) And I once made my father drive me round and round the streets of Monte Carlo in a rented convertible so I could memorize the course. But I have no other direct experience with any other track. I know Watkins Glen, Senator, and it's not too tough for us to tame.

Gentlemen...Wait a Minute

If you're ready to begin, let's get into the game and make a few choices. I know, I know: you think the most important decision you're facing is which car to drive-and, indeed, we're closing in on that-but first things first. Assuming you've already hooked up and calibrated your controller(s), adjusted the sound, and settled into a comfortable driving position, go to the main menu, select Options, and take a wild guess at the choices that might adversely affect your frame rate from the Graphics page. You're not obligated to these choices forever; you can go back at any time (even during a race) and fine-tune them.

And think hard about whether your ego will permit you to begin your virtual race-driving career in either the Novice or the Advanced Trainer. I recommend it. The tendency is to think you're hot stuff, and don't need any training wheels, but even if you've driven a GP car in real life (not bloody likely), you're better off starting slow. The biggest obstacle to mastering "GPL" is frustration. There is no joy in mashing the throttle only to smash into the fence, or to spin off at every turn, or to lock the wheels and sail into the boonies trailing a plume of tire smoke. And even slow isn't quite good enough; you need to be gentle as well. It seems antithetical to the whole notion of racing, of going as fast as you can, of leaving your competition in the dust, but if you don't take it easy, you're not going to make it at all.

The Trainers are detuned versions of the full-powered GP cars. Instead of 400 horsepower, the Advanced Trainer has about half that. And the Novice Trainer has about half as much again. They're capable of going faster than any road car you've ever driven (unless your name is Alois Ruf or Reeves Callaway), and the main thing they're lacking is more torque than you (yet) know how to use. More than anything

else, “Grand Prix Legends” is about the control of power. There are plenty of sims out there that will teach you about how to stay in the “groove” and follow the racing “line,” but only “GPL” will give you an appreciation of what 1967 Grand Prix drivers had to face as a daily occupational hazard: enough horsepower to light up the tires in almost any gear. That is, they not only had to get a handle on lateral acceleration, they had to be as judicious with the throttle as Cruz Pedregon, Kristen Powell, or Ron Capps.

There are several more driver “aids” that you may want to invoke at this time. Throttle Help has something of the same effect as the engine governors in the Trainers, only instead of limiting the available horsepower, it acts like ATC (Automatic Traction Control), and cuts back on the power only when it detects wheelspin, not all the time. (There has since been an era in Grand Prix Racing-in the early 1990s-when sophisticated “fly-by-wire” throttle systems made it almost impossible to spin the driving wheels, but this wasn’t even a gleam in Ron Dennis’ eye back in 1967.) It’s easy to fall in love with Throttle Help, but my advice is: don’t. It will mess you up for later on. That is, it’s a crutch that’s hard to lose, because, basically, you have to start all over again from scratch when its time to do without. Finally, once you learn what adjustments to make from the Car Setup menu (see next chapter), you’ll soon realize that a setup optimized for a car with Throttle Help is wildly inappropriate for one without (the chassis and drivetrain adjustments will differ markedly).

On the other hand, I’m of two minds about both Braking Help and Automatic Shifting, because it’s relatively easy to lose these aids once you’ve learned everything else (that is, without having to retrain yourself). While you’re learning, employing an automatic shifter (note: it is not an automatic transmission) is one less thing to worry about. But in the back of your mind, your ear is learning the shift points. Somewhere down the line, once you’re more comfortable driving these fire-breathing battle wagons, you’ll find you’re anticipating the shift points. From there, it’s a small step to tapping the manual-shift mechanism (usually a button, sometimes a lever) on your controller at the appropriate moment. The down side is that you won’t have full control over the gear selection until you’re out of the automatic mode. There are a number of places at Watkins Glen, particularly, where you want to be in a higher gear than the automatic shifter will put you, so as to reduce the torque multiplication, and, thus, wheelspin.

The really tricky choice is Braking Help or not. With this aid turned on, the brakes are essentially “digital;” that is, on or off, mimicking ABS (Anti-lock Braking Systems) on passenger cars. Stomp on the brakes, at any speed, straight or sideways-by-the-silo, pulling positive “G’s” at the bottom of a dip, or even flying through the air, and you simply cannot lock the brakes. Unrealistic, but, like automatic shifting, your ear “learns” where the brakes tend to lock up, because you’ll hear a tiny squeal of protest (going over the hump at the end of the Straight at the Glen, for example, when the car gets light) where you should ease up on the pedal if you didn’t have Braking Help.

Four Wheel Drift

Without Braking Help, your stopping power is "analog;" you have to modulate the brakes, backing off when you sense the onset of lock-up (if you can't hear the squeal, look at a front tire-if you can read "Goodyear" or "Firestone," it's stopped turning), and gently applying more pressure if the corner is still rushing at you too quickly. (You'll also have to learn which end of the car locks up first: if it's the front, you can't steer; if it's the rear, the car will swap ends. Or, in the words of D.I. Arnao: "A sliding tire has no directional integrity, Mister.")

Brakes That Don't Fight Back

There's one big point of departure from real-world brakes in "GPL" which can cause kinesthetic confusion. Real-world brakes are pressure- and travel-sensitive. That is, the farther down you depress the pedal, the firmer the resistance, and the greater the braking effect. Very few computer-racing controllers exhibit any pressure sensitivity-the pedal doesn't get any firmer the farther it's pushed. Many people (including me) find this disconcerting. Some gamers have stuffed an air bladder under the brake pedal to simulate a pedal that "pushes back." Take your own counsel here. I started with no power reduction, automatic shifting, and both Braking and Throttle Help. I got rid of Throttle Help almost immediately. Braking Help took a while longer, but once I dumped it, it was a cinch to come to grips with manual shifting.

Wisely, I think, Papyrus has deliberately "fudged" the advantages that Braking and Throttle Help might confer, so that your lap times will suffer if you employ them. (It would have been real easy to impart an unfair advantage here.) Just how much of a penalty was still under discussion as of this writing, but suffice it to say that weenies with all the driving aids turned on won't be beating anybody who's learned to do without these crutches, and if your personal bests are still better with them on than off, you need to dig a little deeper, try a little harder. (And it should be mentioned that the power-limited Trainers won't allow you to run wheel-to-wheel with the Big Dogs-but you can match nickels with "best-in-class" Hot Laps.)

To Clutch or Not to Clutch: *The use of a clutch is new to auto racing sims, although most experienced players probably won't recognize its absence as an aid (although I guess you could think of its presence as a "reality enhancement"). Thirty years ago, a driver only needed the clutch at the start of a race, to get under way, after which a "crashbox" (a manual transmission without synchromesh) could be shifted all race long by just matching the engine speed to the speed of the gears (easier than it sounds). Nowadays, drivers still only need the clutch at the start; during the race, shifting is done with buttons, just like sim racing.*

In "Grand Prix Legends," you don't even need the clutch at the start (just get the revs up, and when the green flag drops, punch the gear selector), and you don't need it to shift up or down, so what is it good for? Spin control! Once you get the tail of the car

hung out so far that a spin is inevitable, you have two options. One, declutch and start downshifting, so once the car comes to rest, you're ready to rejoin the fray. Or two, leave the clutch engaged and apply full throttle to "help" the car complete the spin. If you don't take some action like this, your car will often violently "re-stick" after the first 180 degrees, leaving you facing backwards and dead in the water. Of course, by the time you're experienced enough to employ advanced techniques like these, you shouldn't be spinning in the first place.

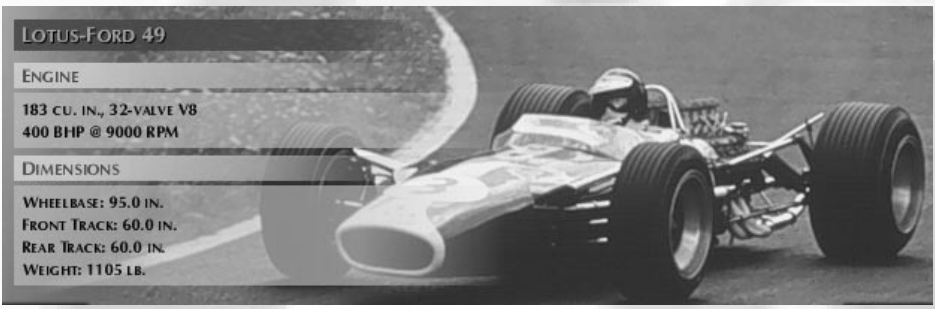
What's the Damage?

Finally, you probably want to select the Damage Model (from the Training menu) to None ... or Novice, if you don't expect to hit anything. As you get into longer-distance races, "GPL" will set this for you. Be advised that as you move up the Damage Model ladder toward Realistic, it's not just your bodywork that's at risk. (Well, you can tear the wheels off and scatter some body parts, but you can't trash the "tub.") "Legends" also models engine damage from abuse: there's a rev-limiter and you can't miss a shift (it's a sequential shifter, like a motorcycle), but you can over-rev on a downshift or buzz it to the redline and leave it there, or speedshift without lifting the throttle. Your engine may start to lose power, oil pressure, start to smoke, catch fire, or blow up altogether.

Before we head out for some exploratory laps, let's take a minute to contemplate which car, exactly, you might want to drive ... based on something more than purely romantic notions that such-and-such a car ought to be fast.

From an historical perspective, you'd want either the Brabham-Repco (the car that actually won the Manufacturers Championship and carried Hulme to the Drivers Championship), or the Lotus-Ford, which was clearly the fastest car whenever it was running, but there are more issues here than reliability (the Brabham had it; the Lotus didn't), and there are good reasons to consider the Eagle-Weslake, the BRM, or the two fantasy cars (Coventry and Murasama). Let's take a closer look.

The Lotus Blossoms

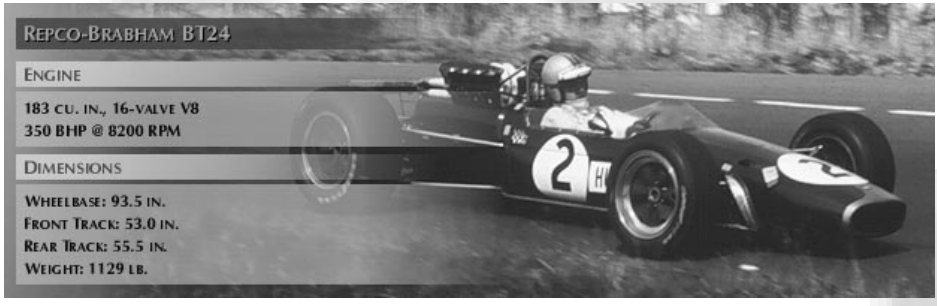


Four Wheel Drift

The Lotus, a tiny car with a low polar moment, is far and away the fastest car in the game, as it was in real life, and if your main interest is in Hot Laps (where reliability doesn't count), there is no reason not to choose it. Not surprisingly, it's also the hardest car to drive. It's nervous, pointy, just short of squirrelly. It's what engineers call a "high response/high gain" machine, meaning that it not only responds with alacrity, it will also over-respond to any but the most delicate control inputs. It takes quite a while to get used to, but once you're comfortable with its hypersensitivity, the BRM, for example, will feel as ponderous as the "Queen Mary" by comparison. The 49's engine, the Ford DFV, is not only a compact, lightweight design, it revs quickly and freely, with gobs of torque (something else that makes it hard to drive), unlike the BRM's fussy, complicated H-16, which responds sluggishly at low revs.

Whether you're a novice or hard-core, it's hard to criticize choosing the Lotus. Newbies will gravitate toward it because of its fearsome reputation, and experienced sim racers will immediately appreciate its suitability to the task at hand. But it is hard to drive.

Brabham's Brabham



The Brabham is not quite what you'd expect. With its down-home (and Down Under) origins; the blue-collar beginnings of its honest, working-man's V-8; and its simple Formula 2 tube-frame chassis, you'd think the BT24 would be the Model T of Grand Prix cars, but it's surprisingly tricky to drive (as opposed to the drive-it-like-you-hate-it BRM). Sgt. Arnao attributes this to its short wheelbase and narrow track-even small inputs result in dramatic vehicular response. The brakes, for example, seem far more effective than any other car's-so powerful that you'll look ridiculous coming to a complete stop several yards short of the corner, and so touchy that you have to make sure the car is not only pointed straight as a ruler but also completely settled on its suspension before you (gently) caress the pedal, or else it will start gyrating like a top.

The Repco V-8 (with its single-cam, non-crossflow heads) doesn't have much of a rev range, but the power curve is fat, and you don't have to keep it "on the cam" the way you do with some of the other engines. The BT24's chassis is trickier with different

setups than the other car's (see next chapter), but once you're "hooked up," it's extremely well-suited to courses with a lot of switchbacks, like the Nürburgring. At the end of the day, over the long haul (full-length races or the complete slate of 11 World Championship events), the Brabham should be the one to beat. Its reliability won it the Championship, for sure, but other benefits accrue from its minimalist approach: better fuel mileage among other things. Even its small physical size is an asset at tight tracks like Monte Carlo.

The Beast of Bourne

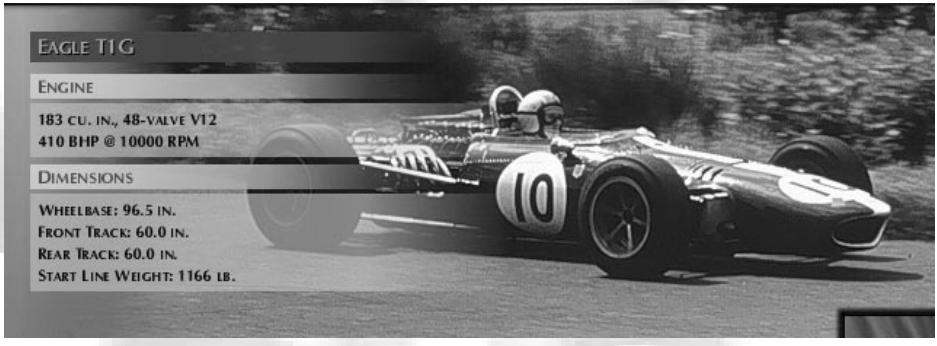
My personal favorite as a beginner's car is the BRM H-16. It may be a dog, but what a magnificent mastiff! By the time of the Italian GP at Monza in September (with only Watkins Glen and Mexico City left on the calendar), it had more horsepower than any other car (according to published reports at the time), but its pup-tent-sized engine cowling nullified its potential speed advantage on Monza's long straights. The car looked pregnant. At the weigh-in, it was obscenely overweight (the heaviest, at 1584 lbs., vs. the lightest, Brabham's BT24, at 1144 lbs.). But for all that, the BRM P115 is great fun to drive in the game. Despite its bulk, you can hurl it around like a medicine ball, flog it through corners like a recalcitrant mule, provoke powerslides that would make Stevie Smith (no relation) blanche, and tromp on the pedals like trying to kick-start a Bimota ... without causing anything so dire that you can't gracefully recover. Usually. Meanwhile, with all 16 cylinders banging away, and grinding noisily through six speeds (every other car in "GPL" has a 5-speed), it makes a gloriously hellacious racket, guaranteed to rid your home of rodents, spiders, bats, and other supersonically-sensitive pests.

The downside is, of course, that you're doing this about two seconds a lap slower than anbody else on the track. Still, the BRM (for British Racing Motors) makes a great newbie's car, both because it's so easy to drive, and because it has so little low-end grunt that wheelspin is seldom a problem (you have to row it around most tracks with the gearshift lever). At least at slow speeds; high in the rev range it makes enough horsepower to Vulcanize the tires.

Four Wheel Drift

I know I'm bound to be lonely in my enthusiasm for this beast, but compare it to the Lotus. The 49 may be one of the world's great designs, but even the great Jim Clark said it was hard to drive. Where everything about the Lotus demands a fine, light touch, the BRM may be manhandled with impunity. (The 49 doesn't suffer fools like me gladly.) In a field full of Lotus 49s, I'd never win. But if everybody was forced to drive a BRM H-16, I might have a fighting chance. Spec racing, anyone?

Dan Gurney for President!



Gurney's Eagle-Weslake is my overall personal favorite, because it's easy enough for a duffer like me, yet fast enough to make me look good (even though its real-life reliability left almost everything to be desired) It's easy to drive because of its high polar moment: the dumbbell effect that makes a car stable but slow to warp off the straight and narrow. (Polar moment is easy to demonstrate: You can't balance a broom on the palm of your hand straw-side down, because the mass is concentrated at the wrong end, but invert it and it starts to tip over so slowly that you've got plenty of time to catch it.) The Eagle had a long, long V-12 in the back, and long, long Dan Gurney in the front; the chassis was sized for his 6-foot, 4-inch frame. The Weslake engine is not only powerful-about on a par with the Lotus'-but smooth as buttah all the way from idle to its 10,000-rpm redline (probably because its designer, Harry Weslake, was a gas-flow expert who chiefly designed cylinder heads for a living). The Eagle's V-12 may have lacked reliability, but it poured out torque like an avalanche of honey.

On almost every track in "Grand Prix Legends," the Eagle is within a few tenths of a second as fast as the Lotus (the exceptions are Monte Carlo, for sure, and maybe the Nürburgring, although I'm not experienced enough to be certain), and always easier to drive at or near the limit. But even if it wasn't, I'd probably drive it anyway because it was part of my heritage: when I was at Car and Driver in 1964, we sponsored Dan Gurney for President-against Barry Goldwater-but the GOP didn't get the message, alas. The only thing the Eagle has going against it in a run for the Championship is its reliability record, all too accurately modeled in the longer races.

The "Ringers"

You shouldn't write off the Coventry or the Murasama as field-padding or "starting-money specials," either, although it seems unlikely that you'll want to stay with these fantasy marques after much more than a brief test drive. The Coventry is relatively well-behaved, with smooth handling (its long wheelbase makes it clumsy in tight turns, however), light weight, and good power, kind of like a shoelace-cousin of the Eagle. (Like the Eagle, it does well at long courses like Spa, although I never felt comfortable at Monza with it.) Racing being the intensely competitive sport that it is, few players will want anything almost as good as a winner, so I don't expect too many takers here.

The Murasama seems to have tremendous reserves of power (judging from side-by-side drag races), but it doesn't come off the turns with anything like enough authority to keep abreast of the other cars without a tow (slipstreaming). That is, on its own, the Murasama can't pull out much of a lead. Later on, when you get into Multiplayer racing, two players could team up and both drive Murasamas at Monza, say, or Spa, and maybe get a leg up on the opposition, but again, as racing (real or virtual) is more competitive than cooperative, you probably won't find too many players choosing this car for anything other than its well-remembered exhaust note ("raucous" doesn't begin to cover it). You might compare it with the BRM-it's got better acceleration, but isn't as much fun to drive.

Good to Go

Don't bother making any chassis or drivetrain adjustments just yet. The default settings are adequate for learning the ropes, and no matter what settings you fiddle with, they won't mean much to you until you've educated "the seat of your pants" so you can tell the difference between, say, too steep an angle on the coast side of the differential, and a pinch of toe-out at the front end. Say wha'? I'll explain ... all in good time.

Wait, wait! There is one change in the Car Setup menu you'll want to make before we begin, no matter which car you've chosen. From the first page, upper right-ish, you'll see how many gallons of gas you're carrying. The maximum varies according to the car (the already-heavy BRM and Murasama have the most: 50 gallons, and the already-svelte Brabham has the least: 35 gallons). At about six lbs./gallon, the difference between full and empty can be as much as 300 lbs., and a full tank will make any car feel like lead. You may be tempted to reset the fuel load to 5 gallons, which is fine for qualifying and Novice races, but you'll be in for a rude shock the first time you have to

start a race with full tanks. I'd recommend settling on 10 gallons for each car for the nonce. (The cars were supposed to be fueled with 100-octane "avgas" or aviation fuel, but some exotic brews were tried on the Q.T. Cheating was harder to detect in those days. Like many of the other regulations of that era, compliance was mainly on the "honor system.")

Now Comes Seat Time

Let's go for a slow-speed orientation tour ... and let's establish some shorthand naming conventions to save time. Hereafter, I'll refer to T1R if Turn One is a right, and/or T7L if Turn Seven is a left (unless I refer to the turn by name, like the Glen's Big Bend, aka T6R). G1 will be first gear, and so on, and G2-G1 would be a second- to first-gear downshift. L5 will be your fifth lap (not the same thing as the "L" on your pitboard, which refers to the number of laps yet to be run in a race). And P3 means your position in the race (or qualifying) is third. Et cetera.

In the pits

When you get to the first-person in-car (cockpit) view, snick your car into G1, but do not mash the throttle while you're on the pit road-you'll only embarrass yourself by spinning out from a standing start, with everybody watching. Squeeze on a little power, like caressing a rifle trigger (as if you're Sgt. Arnao ... although Doug's visualization here is like eggs under the pedals), or clicking a camera shutter (if you're Rainer Schlegelmilch), and ease out of the pits with as little *sturm und drang as possible.*

Listen up; **THIS IS IMPORTANT!** While you're still learning a circuit-the basic stuff: which way the turns go when they disappear over a hill or around a blind bend-you want to be "short-shifting," well below the redline. That is, the last thing you need to cope with right now is a lot of torque and tire smoke, signifying nothing. Keep it down. (I mean, this is assuming that you're doing the Right Thing and are shifting manually, without ATC. If you're in the automatic mode, you're in whichever cog the computer thinks you should be in.) Loaf along. If you grew up around car "buffs," you'd probably rather die than lug an engine, but these puppies can't be hurt by pulling from

low revs. On the other hand, you can get in a whole mess of trouble shifting at-or anywhere near-the redline.

The Esses


Turn One (Right)

Your first upshift (G1-G2) should come as you hug the righthand guardrail and motor gently up the hill through the first of the Esses. Later on, at speed, you'll sashay through these three turns as if they were one, but for now just imagine you are racing in slow-motion, and the most important part of the exercise is following the "groove" (a graphics option I hope you've turned on). This greasy gray-and-black streak serves two purposes. One, it should give you a good indication of where your car should be, laterally, on the track, at any given point. Two, where the gray suddenly becomes darker is where a lot of guys before you have slammed on the brakes. That is, the groove is not a mandate, an absolute, it's a record of where a lot of machinery-from econo-boxes to Can-Am racers, from the look of it-have laid down some rubber. It's not infallible, but it's as good a landmark to start with as the third bush from the right on the side of the road.


Uphill intoTurn Two

I'd upshift again (G2-G3), once your car is pointed straight, in as smooth a transition from T1R to T2L as you can muster. Apply a little power. Gently. Short-shift. The Esses is probably where you'll learn your first lesson about the control of raw horsepower; it's easy to get carried away here-rushing pell-mell up the hill-and smoke the rear tires. (Remember: a sliding tire has no directional integrity ... no matter which end of the car it's on.) Follow the groove. Straighten the car out and short-shift again (G3-G4) between T2L and T3R. Hug the rail


Turn Three (Right)

("against the fence" in horse-racing parlance) all the way around T3R until the hill flattens out and the momentum of your car carries it over to the left, then grab G5 (if your car has it). Gently.

The Straight


The Straight

There follows a long, slightly uphill straight (called simply the Straight before the course was changed and the pits were moved; now it's the Back Straight), which disappears over a slight rise in the distance. At racing speeds, your shut-off point, right where you'll be jumping on the brakes, is that billboard over on your left. At touring speeds, you may likewise use the billboard as a reminder to roll out of the throttle and softly apply the brakes. If you have Braking Help on (I did at this point in the learning curve), the car will simply slow down in direct proportion to how much braking effort you apply. If you're brave enough to have Braking Help off, you'll notice that it doesn't take much to lock the brakes (smoke-if you have the effect turned on-will pour off the offending tire). You will have to remember to leave enough space ahead of you to "modulate" the pedal-that is, back off until the wheel starts turning again; then get back on the brakes-only this time hopefully without locking 'em up. And note that it can be as unsettling to suddenly let up on the brakes-particularly if you're turning slightly, or are out of the groove-as it is to apply them too much, too quickly, or too soon.


Setting Up Turn Four

The end of the straight disappears over a small rise, where it dips down and into what used to be called the Outer Loop, a long, sustained righthander which funnels into what is called the Chute. Even at an orientation pace, you should be able to note the curvature (camber) of the road, which makes the inside line through T4R banked like the Carousel at Elkhart Lake (or, as we shall see, the Karussel at the Nürburgring). Normally, racing practice is to "straighten" the turns as much as practical by starting at the outside edge of the track, then sweeping across to the inside (or apex) in the middle of the turn, then letting the car "drift" wide, to the outside edge, as you accelerate out of the far side of

the turn. Entering the Outer Loop, if you start your turn-in too late, or drift wide too early at the exit, your car will skitter up and over the top of the crown, and you'll be clawing for traction on the reverse-or wrong-side of the slope.


Turn Four (Right)

To avoid getting stuck on the "off" side of the banking of these high-crowned roads, you angle the car very slightly toward the apex just before you begin braking. Unlike modern aero-assisted racing cars, circa 1967 Grand Prix cars do not respond well to trail-braking, where you continue to brake (albeit at a reduced rate) after you begin turning in. In those days, you did like your father told you: get all your braking done in a ruler-straight line, then-and only then-begin turning. If you don't, the car is liable to swap ends. (D.I. Arnao won't let his raw recruits even try trail-braking until they're grizzled veterans.)

The Outer Loop

Coming into the Outer Loop, T4R, you brake on the bias, in a straight line but diagonally across the road, from left to right, so that you stop braking and start turning just as you tuck into the banking effect afforded by the high crown, which will help you around the corner. If you don't time it right; you'll have to "breathe" (modulate) the brakes twice: once as you crest the rise that's been blocking your view of T4R (where the car will get "light"), and again as you traverse the crown (where the car gets light again). As you get better, you'll cross the rise and the crown at the same time, so you only have to back off once. You'll also need to drop two gears here (or three for the 6-speed BRM; but I'm not going to mention this again-the P115 is always going to be one gear higher or lower than everybody else). I usually drop the two gears before the crest; D.I. Arnao downshifts once before the hump and once after.

As you settle into the Outer Loop's banking, you want to "feather" the throttle. That is, neither accelerating nor decelerating. (Note: "coasting" is not feathering; it is a trailing-throttle condition where the car continues to slow down-not what you want in the middle of the Loop.) Later, at speed, you'll be sawing away at the steering wheel like Paul Bunyan through here, but for now, concentrate on being smooth. It's better to be smooth than fast. Follow the groove, and don't get back hard on the throttle until the car is pointed dead straight ahead again.

Coming out of T4R into the Chute is your next lesson in traction control. Later (see next chapter), we'll find some relief in setups which help control wheelspin, but for

now, practice modulating the throttle, gradually applying power from the time the turn starts to open up at the bottom of the dip. If you get on the throttle too soon exiting T4R, the car will pop up out of the banking and spill over onto the reverse-camber side of the road, almost surely putting you onto the grass on the outside verge. The grass is very slippery. (Not as cloying as the sandtraps and, particularly, the bramble thickets at some other tracks, but something to be avoided, if at all possible.) Uh-oh, there you go!

What To Do When Stuff Happens

If ... or, rather, when ... you find yourself spinning, you can either throw up your arms in despair ... or you can do something about it. Most of us would simply de-clutch and ride it out, but this is what beta tester John Wallace suggests when things go horribly awry. As your car spins 180 degrees (a half-turn), "boot the throttle to get the spin to continue right 'round. Back off the throttle, and then, as the tyres [sic] come the full 360, give it plenty of Wellie [a Briticism for Wellington, as in boot] to get the tyres [sic] spinning." Finally, modulate the throttle, "until the tyres [sic] begin to catch ... then power away in a huge cloud of tyre [sic] smoke. Looks totally stupendous and really saves time when things go wrong." Thanks, John.

If you simply let the car come to a stop, you have the option of hitting "Shift-R" (reset), which puts the car back on the road, facing the right way, ready to resume. Maybe now would be a good time for you to review GPL's extensive VCR (instant replay) controls, to see what your spin looks like from a variety of viewpoints. Take your time; I get paid the same either way. Or, if the gods are with you, and you make it through the Outer Loop unscathed, you can let the car out a little as you transit the Chute, just staying over to your left, and accelerating up to top speed (which will ultimately equal or exceed your speed on the main Straight).


Turn Six (Left)

The next turn, which is a lefthand kink (T5L; it had no name back in 1967, according to track historian Bill Green), is taken flat out, without lifting. Once again, the extreme camber of this track dictates that you begin your turn-in not from the conventional outside (or right) side of the track, but from the inside (or left). Indeed, the crown is so pronounced here that if you try to turn in from anywhere to the right of the centerline, your front wheels may not generate enough grip to pull you up and over the crown of the road to the safety of the banking on the inside. It's that steep.

[N.B. For those of you familiar with the Glen in its present configuration, the track up until T5L in "GPL" is about the same as it's always been. The new iteration begins here and stretches all the way to the Ninety ... and includes the new pits and the new Front Straight.]

Big Bend

You hug the inside rail around T5L, pedal to the metal (you should be getting braver by now) until the car is once again pointed in a perfectly straight line, then use up the entire ensuing straight braking for Big Bend (T6R), using the same technique as braking for the Outer Loop. That is, you angle your car diagonally across the road, and brake in an absolutely straight line, on a tangent aimed at the entrance of T6R. The crown here seems the highest anywhere on the track-if you stray too far to the left, entering, traversing, or exiting this turn-you'll skitter off the road on the outside and take a wild ride through a grassy ditch. Or wind up in the fence.

As you're braking for Big Bend, drop down two gears to G3 and feather the throttle so as to maintain a constant speed around the banking on the inside line. At the exit (it's a long turn, but shorter than either the preceding left or the Outer Loop before that), squeeze


Turn Six (Right)

on some power and let the car drift wide, so that you align the car with the lefthand verge just as the track direction reverses into T7L, a shorter, sharper turn than T6R. Eventually, you will learn how to use the energy stored in your car's springs to segue seamlessly into this lefthander, barely more than a kink, just before the last turn (the Ninety).


Turn Seven (Left)

The Ninety

And-one more time-as you power smoothly out of T7L, you will cross the track diagonally, from left to right, up and over the crown; a short blast of acceleration, followed by braking straight as you dive toward the inside banking going around the Ninety (T8R, a hairpin), and downshift again. With some cars-those with little low-end torque, like the BRM-you can drop all the way down to G1. With others, rich in torque-particularly the Lotus-not even a special, extra-tall first gear (a luxury Jim Clark didn't actually enjoy during 1967) will be "long" enough (numerically low) to prevent wheelspin. In either G1 or G2, apply just enough throttle to accelerate the length of the Pit Straight without fishtailing the car. "Only rank amateurs," sneers D.I. Arnao, "spin out exiting the hairpin."


Turn Eight (Right Hairpin)

Congratulations-you've just completed your first lap. Repeat until you feel comfortable enough to want to pick up the pace. Then, as you cross the S/F (Start/Finish) line, stay well over to the left, back off the throttle to get the nose of the car down (which transfers some weight forward so that the front tires have a little extra grip), turn in aggressively for T1R, the first of the Esses, and squeeze on the power. You should be in fourth gear at this point (still short-shifting, although not by as much), and you'll stick with it all the way up the hill.

On successive laps, you'll be going

for a little more speed, but you're not racing yet. You'll be bringing up the throttle a little sooner, staying on it a little longer, and be braking a little later. The object of these exercises is simply to not break traction-apply just enough throttle that the revs don't start to rise faster than the tires can accept the power, and just enough braking effort to get the maximum retardation without locking up the front wheels, or, if the rears lock first, looping the car. (In the next chapter, you'll adjust the brake balance to get all four wheels to lock at the same time.) If you hear the onset of tire squeal in a corner, feather the throttle (don't back completely out of it), and keep on going.

As your car dives for the apex of T1R, roll back into the throttle and keep the right side of the car against the guardrail. Take a late-ish apex, and when the car is perfectly aligned with the righthand side of the road and the steering wheel is pointed straight ahead (the two aren't always simultaneous), enjoy a little blast of acceleration up the hill, feather the throttle again to get the nose down, and use a combination of throttle and steering input to bend the car into T2L.

Sgt. Arnao says that while it is possible to take T2L flat out on a perfect lap, "it's usually more prudent to lift slightly to prevent the front end from washing out." Backing off (aka a "confidence lift" or, less charitably, "foot shrinkage"), will, if you're not right on the ragged edge, usually have the effect of tightening your arc; it can even "pull" you all the way up onto the curbing on the inside if you're not careful. That is, suddenly getting off the throttle will add to the natural "bounce-back" of the suspension (or oscillation, as the springs uncoil), to whipsaw the car back in the opposite direction. Do it too suddenly and the car will spin. Just right, and the car will "see-saw" of its own volition exiting T2L, and set itself up perfectly for the entrance to T3R. All you have to do is use the throttle to keep the nose of the car against the guardrail on the right, and as you apply power, the car will "spill" over to the left as it gets light at the crest. Shift into top gear, and the reduced torque cuts the tendency to drift wide, and you're headed off down the straight at full chat. Easy, huh?

Don't Get Discouraged

The Esses is the hardest part of Watkins Glen to master. Eventually, you'll learn the most important part of any series of compound turns like this is the exit of the last one. Thus, you throw away conventional wisdom (and line) around T1R and T2L to get perfectly positioned to get on the power ASAP exiting T3R. If you get messed up in T1R (say, exiting too far over to the left), you'll have to back way off to make it through T2L, which means you won't carry enough speed through T3R and onto the straight. Very roughly, if you're looking at a replay, you should see about 110-120 mph across the S/F line and into T1R, about the same through T2L, and increasing speed through T3R until you see about 140 mph at the exit (where the Armco barrier on your left ends).

The turns that count the most in racing are those which connect two or more straights.

Mastering the Esses is the key to fast lap times at the Glen. It takes many practice laps to lock it down. Here, Clark shows the pack how it's done.

The Esses connect the short Pit Straight with the main Straight, but more importantly, the Outer Loop connects the main Straight with the Chute, which, in effect, continues unabated through T5L all the way to Big Bend, which adds up to a lot more yardage. As you lap faster and faster, you'll note that even though you arrive at your shut-off point for the Loop faster and faster, the billboard on your left will remain where you throw out the anchor. If the Esses are the hardest, your entry into the Loop is probably the second-most difficult, although what counts the most here is not getting on the gas so soon that you lose the rear end as you transit into the Chute. Wrestle the car into the Loop any old way you can, and concentrate on getting the power down at the exit, and not spinning the car. If you're doing it just right, you'll see the on-screen steering wheel give a little shudder just as you get close to the limit of adhesion.

You'll also notice you don't need much finesse to wrestle the car into Big Bend (although keeping the car pointed straight in the braking zone preceding T6R is a job-and-a-half); just make sure you don't spill too far left until you're in the entry "pattern" for T7L. And watch out for T8R, the hairpin-it's really tight-and definitely don't get back on the throttle so soon that the car starts to snake left and right on the Pit Straight.

That's about it.

"Take off Those Rookie Stripes, Cherry!"

Keep going round and round until your lap times stabilize. That is, it doesn't make much difference how fast you're going; it's consistency that counts in "GPL." When you can do 20 laps within a second of each other, without spinning, crashing, or hitting Shift-R, you're ready for the next step.

Which is: pick a new car and start all over again. By the time you can do 20 consecutive laps within a second of each other with the next car, you should be able to go back to the first car and discern some differences in the way they accelerate, brake, and go around corners.

If you can't appreciate the gross differences between the cars, you won't be able to feel the subtle differences in the setups, which is the next step. So I recommend that you try out all seven cars and try to achieve at least a modicum of consistency in all of them before you go on to the next chapter.

Chapter Four: Tuning for Speed

"Grand Prix Legends" isn't about setups, it's about driving. Yet, if you listen to the heavy-breathers on the Internet (figuratively speaking), you'd think setups were the Holy Grail. There isn't a newbie alive who doesn't harbor the secret belief that the only thing keeping him or her from driving like Jimmy Clark is discovering some secret combination of setup parameters, like finding the Lost Chord or hidden cheat codes.

There is nothing mysterious about chassis setups, and finding one that works for you is neither black magic nor rocket science. It's mostly hard work-hours of trial and error-and garnering a good race result has more to do with your performance in the cockpit than in the garage. Yet there is no disputing the fact that a bad setup can hurl you into the depths of a clinical depression, and a good one can make driving seem like a walk in the park...only a whole lot more fun.

In the days before aero, race cars were a lot less sensitive to small changes in setups, but without telemetry-it was much harder to pinpoint exactly where the setups might have gone off the trolley. Thus, the real trick is recognizing a good setup once you've finally found one. The subtle differences between "good" and "not-good-enough" setups will be more apparent in the way the car feels to you than the obvious measure of lap times. Particularly at the start of your career as a virtual GP driver, substantive changes in your measured lap times will almost invariably stem from inconsistent driving, and not until you're steady enough to string together a dozen nearly identical laps, even with a bad setup, will you be able to use a stopwatch as a reliable indicator of how the suspension, brakes, and drivetrain are working together. More importantly, only experience will sensitize the "seat of your pants" to the differences between good and evil handling. A seasoned veteran can usually tell if a new setup is "hooked up" before he or she even finishes the first pit-out lap. Sometimes you can tell before you get to the second turn.

Virtual Drivers; Real Advantages

Indeed, the "GPL" driver has an inestimable advantage over real-world 1967 drivers, who often got no more than an hour or two of practice at each new venue before the race began. Most 1967 drivers had no previous track experience (in club racing, for instance, at a place like Kyalami, in faraway South Africa) before they blew into town with the GP circus. While still in the pre-alpha phase of "GPL," Alison Hine remarked that she probably already had driven more laps of Monza than had Clark in his entire career. You can choose any track from the Training menu and drive as many laps as you like, trying one setup after another, until you find one that works for you. Then you can check it out as many times as you like in the Single Race mode before you ever have to put it to the acid test of a full-fledged World Drivers Championship race. In other words, you've got plenty of time to get "dialed-in," track by track, car by car.

In the real world, the teams did very little testing (except for those fortunate enough to have their own test track), and often did little more than develop one basic setup that would be modified to suit the task at hand-"taller" gearing, say, for a track with long straights; or added ground clearance for bumpy circuits; or changing carburetor jets to accommodate Mexico City's mile-high altitude. Some
teams, chronically understaffed and overworked, would arrive at a World Championship event with the car still set up for the previous one, the interval between the two events having been fully occupied with fixing what was broken. These are privations that the virtual GP driver will never have to suffer.

What we're going to do in this chapter is learn what all those numbers on the Car Setup pages mean, what effect they have, when you should change them, by how much, and how to tell when you've gone "over center," that is, when enough is enough. Steering feel numb around the center? Try this. Does the suspension seem "nervous"? Try that. Front wheels not getting enough bite when you turn in? Back end "stepping out" when you mash the throttle? Engine "lugging" coming out of the hairpins or over-revving on the straights? Here's what every adjustment is for ... and what changing the values should feel like to you in the cockpit.

And who's going to teach us about all this?

Meet Dr. Ing. Doug Arnao, your genial race engineer. Hey, wait a minute! Isn't this the same "D.I." Arnao who was our militarily-correct driving instructor in the previous chapter? The same. Only now, exchanging his Nomex gauntlets for a mechanic's overalls, he's the Doug Arnao who owns Vehicle Craft ("suspension and brake upgrades") and moonlights for Papyrus as a consultant. Better make that a lab coat. Doug is the only guy I know who's equally at home in three disparate auto-racing universes: the theoretical (he's read and understood every word of the Millikens' hopelessly arcane "Race Car Vehicle Dynamics," a thousand-page tome as dense as a scientific treatise

debunking cold fusion), the practical (building and driving his own race cars), and the virtual (his name is writ large on Hot Lap top-ten lists worldwide). And he can connect the dots between them. Over the years, I've found Doug's setup advice invaluable, so I have again turned to him for help here.

While Watkins Glen is a great place to begin our exploration of "Grand Prix Legends," it is not ideal for demonstrating the effects of different setups, because its "banking" (a consequence of its high-crowned road surface) tends to conceal a multitude of sins, and because its elevation changes-however modest-only further cloud the issue. Besides, you're probably ready for a change of venue by now, wot?

Study Abroad

Accordingly, we're moving the Race Driving 101 school to the 3.57-mile road course at Monza, home of the Italian Grand Prix since 1922, when the track was built within a park on the outskirts of Milan. The circuit has gone through many iterations (including the addition-now abandoned-of a 2.3-mile high-banked oval shaped somewhat like the famous Indianapolis Motor Speedway), and in 1967, Monza was the fastest purpose-built road-racing circuit in the world, with average speeds of over 145 mph per lap. Those of you familiar with Monza from modern-era TV coverage will hardly recognize the place-speed-stifling chicanes have turned it into an emasculated shadow of its former self-but in "GPL" it has been magically restored to its original grandeur ... and it just happens to be perfect as a test track for demonstrating chassis setups. "Our own private skid-pad," as beta tester Alison Hine put it.

Jochen Rindt tries to slip beneath Jack Brabham at the Parabolica. This famous corner offers a driver many choices as to the best plan of attack, but rewards consistency with quick lap times.

Like the Glen, Monza is a simple, uncomplicated track, and short enough to easily to commit to memory. There are only four real corners: a fast, top-gear sweeper (the Curva Grande), a pair of third-gear grinders (the two Lesmo turns), and the eponymous Parabolica, which starts off slowly and opens up as it spills out onto the main straightaway. (There are also a couple of flat-out kinks, only one of which-Vialone-should give you any trouble.) After the Lesmos but before the back straight there's a tun-

nel under the old banking (a location which features prominently in the final race in the movie "Grand Prix").

Monza's only noticable change in elevation occurs at the tunnel.

Unlike the Glen, the road surface at Monza is wide, flat, and almost entirely devoid of any elevation changes which could affect suspension settings or your driving technique. The Curva Grande has a protracted, constant radius, making it ideal for checking out how the car handles with the power on, neutral throttle ("steady state"), trailing throttle, and the transitions between them (like suddenly snapping the throttle closed). The Vialone kink will show how well your setup handles high-speed bends. The Parabolica's increasing radius is useful for demonstrating how well the car "accepts the power" as you squeeze on more and more throttle exiting the turn, as well as what happens when you're forced to change gears in the middle of a turn (hint: short-shift).

And unlike the Glen's fiendishly troublesome Esses, Monza's two Lesmo turns are less tightly coupled; if you screw up the first, you're not doomed to ruin the second, but they are connected by more than just the short chute between them. The first is preceded by a long, hard pull at the brakes, but the entry itself is undemanding-almost anything short of spinning the car will do. What counts is the exit, which should be very controlled (not wild, opposite-lock power slides), because the second Lesmo has a narrow, fussy entry, and if the car is still snaking around at the end of the chute, your entry will be off ... and so will you (on the inside or the outside, depending). "Never arrive at a corner with the car pointed the wrong way," says D.I. Arnao. Exiting the second Lesmo is a case study in what happens when you put the hammer down ... an act which can have startling results if you've got the wrong differential settings.

Taken together-with everything you've learned about driving at the Glen, and what you'll learn about driving and setups at Monza-you'll be well prepared for almost every other track in "Grand Prix Legends." Except for the Nürburgring, of course-nothing can ever prepare you for the Ring. But we'll cross that particular bridge (Adenauerbruecke) when we come to it.

Reviewing Your Options

Let's get started. From the Player Info menu, choose your favorite car (based on your experience at Watkins Glen). Now would also be a good time to reconsider which, if

any, driver aids you want to lose. As mentioned, the last thing you want is Traction Help-if you start with this, you'll have to go back to square one to develop setups that work without traction control. Braking Help won't screw you up as badly, but your lap times will ultimately suffer, so lose it if you can. Automatic shifting (or not) doesn't much matter at Monza, but the car will be harder to control if you're forced to accept whatever gear the computer sticks you in. If your steering felt a little touchy at Watkins Glen, you might move the Steering Linearity slider a little more to the right. And any settings which would affect the frame rate should be left the same (you sure don't need stuff like crowd texture while you're in training).

A word from Doug about testing methodology: "Never, ever make more than one adjustment at a time." Otherwise, you won't have the foggiest idea of which one did what, so no matter what the result, you'll have to go back and do what you should have done in the first place if you're ever to glean any useful information. I'd also keep track of your setups, what changes you're trying-and the perceived effect-on a separate piece of paper. In the real world, they're called "setup sheets," and every car has a sheaf of 'em. Three-by-five index cards will do nicely here, although if you have a spare computer (a laptop, say) that can be pressed into service, you can use it with a simple database like Claris' FileMaker to track the changes, to compare one setup with others, and to display more than one at a time. I just wouldn't trust my main gaming computer with all my hard-earned setup information. It's easy enough to reinstall the game if your system crashes, but this won't bring back your precious setup information.

There are really only two objectives to any setup: to make the car easier to drive, or to make it faster. The default setups that ship with "GPL" are okay...only you won't know how good they are until you start trying different setups. (Don't worry-you cannot accidentally delete the defaults; they'll always be the first item in each track's setup directory.) Before you start making chassis adjustments, let's establish a baseline with the default setup.

What we're going to do is send you out on the track, let you get used to the default setup, then start tweaking the setup to make the car faster or easier to drive, one adjustment at a time. Once you begin to see the result, we're going to make a determination whether it's better or not, then try it both ways until you can figure out what the optimum setting is, then go on to the next adjustment. Although, as we've seen, all the cars in "GPL" have their own distinctive characteristics, the way (if not the degree) they respond is similar. Too much front brake bias, for example, will

make the front wheels lock up under heavy braking, regardless of whether you're driving a Lotus or a BRM. So which car (or cars) you want to experiment with first doesn't matter much, but your approach to changing the setup values should remain the same...and it's not necessarily the order in which these parameters are presented in the Car Setup menu (i.e., top to bottom; left to right).

Mo' Track Time

Ready? From the main menu, select Training, change the venue to Monza, and cinch up your seatbelt. Pull out of the pits and angle over toward the left side of the track, but keep an eye out on the right for a chain-link fence that divides the track into two roads. You don't want to take the road on the far right-it once led to the banking (the cars raced clockwise, unlike American oval-track practice), but in "GPL" it leads nowhere-you'll run smack dab into a barricade if you go exploring. Stay to the left until you see the Curva Grande looming in the distance. At touring speeds, you don't even need to slow down. Later, at racing speeds, you'll need to use the brakes for this 135-mph righthander, and maybe even drop down a gear.

Coming off the Curva Grande, the road disappears around a lefthand kink called the della Roggia, which is gentle enough that two cars can negotiate it side by side at racing speeds without lifting. The short straight that follows leads to the first of the two Lesmos. I find it difficult to estimate my distance from the entry to this turn, but you don't have to be particularly tidy here; you can get all crossed up in the first part, so long as you exit with the car perfectly straight. At touring speeds, make a mental note: this is the sharper (and more protracted) of the two Lesmos.

As you exit the first Lesmo, the second one appears in the distance at the grandstand. Because Monza is such a fast circuit, these two very important corners are arguably the most overlooked.

You should exit the first Lesmo aligned with the guardrail on your left and stay there until you turn in for the second Lesmo (another right) a few hundred yards up the road. The apex of the second Lesmo is critical because it predetermines your exit path-you don't want to run wide here because you will get mired in the bramble thicket on your left. Even if the bushes don't tear your wheels off, you will be as stuck as if you were up to your axles in quicksand.

The road goes under the oval (if you turn your car around past the tunnel you can see what remains of the old

banking), up a gentle hill, and bends around the Vialone, a long lefthand sweeper. At speed, some cars handle the Vialone well enough that you don't even need to burp the engine (the Brabham, for example); others require a lift followed by plenty of throttle. Doug Arnao's trick is to run a very "tall" fourth
gear and not shift into fifth until he's on the back straight. This will also give you a gear long enough to use in the Curva Grande, if you feel the need to drop down a gear for it.

At the end of the back straight (you're immediately behind the pits here), you have to brake sharply-even at touring speeds-for the Parabolica. Under racing conditions, the approach to the Parabolica is one of two opportunities to out-brake your rivals (the first Lesmo is the other). You approach at top speed, and the entry to the Parabolica is dead slow, so this will later be a great opportunity to learn all about brake bias. Exiting the Parabolica without wheelspin is key here-the tendency is to want to get back on the throttle too soon, but as you'll see, this temptation is to be resisted.

Don't "Cut Clean" and Coast In

As you come back onto the pit straight, you'll see a road joining the track from your left. This is where the oval rejoined the road circuit. You can either pull into the pits or do another lap. (I'd keep going until you feel you know the circuit pretty well, if I were you.) When you're ready, instead of driving into the pits, hit the "ESCape" key just as you clear the end of the steel Armco guardrail on your right, proceed directly to the Car Setup menu, and check your tire temperatures (the box at the lower righthand side of the first page).

Why look at the tire temps first? This will take me more than one paragraph to explain.

First and foremost, every setup should keep the rubber in intimate contact with the road at all times (or as much of the time as possible if you insist on getting the car airborne ... although a good setup should help keep you glued to terra firma in the first place). This means that all four wheels should be perpendicular to the road surface, that the suspension should keep the tire pressed to the road no matter if the car is rolling from side to side or bouncing up and down, that the brakes should prevent one wheel from locking up if the others are still turning, and that the differential should apply the engine torque to the wheel with the most traction. Once these four basic criteria are satisfied, further adjustments may be aimed at helping the driver keep the car under control, that is to say, more driveable.

The most important initial consideration is camber, which is the part about keeping the tires perpendicular to the road. When the car rolls sideways under a cornering load, or pitches forward under a braking load, or accelerates, the static Camber (the value shown in the Car Setup menu) will change. At rest, the tires are (usually) neither perpendicular to the road nor parallel with each other for the simple reason that the static geometry doesn't matter. What counts is what happens at speed, and in "GPL" the only indication you have of how well the tires are doing their job are the tire temperatures across the tread. In modern race cars, telemetry can tell the race engineer in the pits what the tire temperatures are while the car is still out on the track. In 1967, the engineers could only measure the tire temperatures (with a probe called a pyrometer) once the car returned to the pits, after the temperatures had started to cool down. In "GPL" there's a compromise: hit the "Escape" key while you're out on the track, return to your pit and you can pop up the Car Setup menu and have a peek at what the tire temps are at that moment. At Monza, coming off the Parabolica is an excellent point at which to measure the tire temps.

The temps are measured at the center of the tread, and at the inner and outer edges. If the temps are even across the tread, the suspension is doing its job. If a tire's outer edge is hotter than the middle or the inner edge, it means that the suspension hasn't been keeping it upright; it's been leaning out (away from the car) at the top. This is called "positive camber." Conversely, if the inner edge is hotter, the tire has been leaning toward the car-negative camber. So, first, last and always, you want to check the I/M/O (Inner/Middle/Outer) temps for each tire, and if they're not even, you add a click or two of negative camber at that corner of the car if the outer edge is hotter, and vice versa.

[N.B. This just in: Dr. Ing. Arnao took one look at this thesis and insisted I add an important qualifier here. To maximize the benefits of "camber thrust," you really need to be seeing slightly higher temps at the inside edge of the "loaded" or outside tire. This can be accomplished by zeroing the tire temps across the tread and then adding a quarter degree (or so) of negative camber to your settings, but there are three exceptions to this "rule of thumb:"

Four Wheel Drift

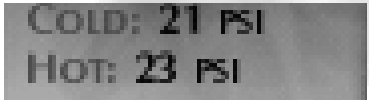
1. On a track with a lot of slow corners (like Silverstone), the rear end will squat more under heavy acceleration. Squat causes the rear camber to go more negative, so you either don't add any further negative camber to your zero-difference settings ... or you could just aim for rear settings that show the outer edge a couple of degrees hotter than the inner edge of the outside tire in any given turn (i.e., the right rear in a left turn). Thus, under acceleration, the tire will be perpendicular to the road, minimizing the tendency to fishtail.

2. "A fast, aggressive driver will pull more 'G"s and hence make the car roll more, thus the more negative static camber needed," because roll causes positive camber "gain," as Doug points out. In other words, if you're a hot shoe, you should factor in another dollop of negative camber ... at both ends of the car.

3. Finally, banked or highly cambered corners (like most of those at the Glen, some of those at Zandvoort, and the final turn at Mexico City) will also require an additional measure of negative static camber to allow the camber to "catch up," in Doug's words, with the track surface.

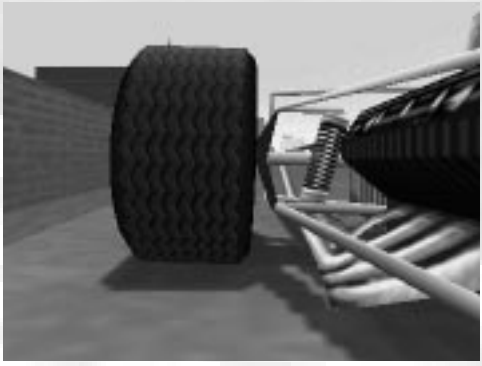
Confused? Dyslexia be not proud.]

Tire Pressure



If it wasn't for tire pressures, you'd only need two measurements at each tire: inner and outer. The middle temp tells you whether you've got too much air in the tire or not. With too much pressure, the tire will bulge slightly around its centerline, causing the middle temp to be slightly higher. An underinflated tire will show a slightly lower middle temp. So once you've got the inner and outer edges equal (which you won't know until you go back out on the track for further testing), you add or subtract air until all three are the same. This is called "zeroing out" the differences, and every time you make any other adjustment (or even change your driving style), you want to check the I/M/O temps and zero them out as necessary ... providing you've been out on the course long enough to get them up into the proper operating range (very roughly, 110-180 degrees).

Later on, after you've aced everything else, you can fine tune the center temp to change the way the car behaves. A slightly underinflated tire will have slightly greater grip; a slightly overinflated tire will have slightly less rolling resistance. So on a track where you need every ounce of traction you can get (Monte Carlo, for example, or the Ring), lower the temps one lb. (psi) at a time until the temp drops one degree. And on a track where straight-line speed is paramount (such as Monza or Spa), increase the pressure one lb. at a time until the center temp is higher by one degree. Don't mess with this until you've run a bunch of laps, however; its effect is so subtle as to be undetectable by most novices.



The Camber and Tire Pressure adjustments are not the values to start with; they are something you should keep referring to, just in case something else has caused them to stray from the straight and narrow (unlike many other adjustments, these values are absolutes-there's no way I/M/O temps of 97/83/125 are anything but just plain wrong). And there's nothing that says they have to be the same for each wheel: unless you are a very slow driver, or have discovered asymmetrical chassis setups (see below), there's little chance that they're going to be the same, even at the same end of the car.

[N.B. Another advanced setup feature is the ability to adjust the right side of the car independently of the left side of the car. This is something that was rarely tried in 1967; Grand Prix teams didn't really get into this until Jacques Villeneuve arrived in Europe from American single-seater racing in 1996 and showed them how. Basically, you might want to try asymmetrical setups-to zero out the lateral tire temps-once you've become completely familiar with every other adjustment on the cars. Even then, you'll never be able to get the temps to match longitudinally. And don't get crazy here; you're much better off having the tire temps-at the same end of the car-mismatched by a degree or two than having the cambers mismatched by more than half a degree or so. This is because it's harder to brake the car in a straight line if the front wheels, particularly, are cambered at different angles. The only track where asymmetrical setups are an unqualified success, in my experience, is Watkins Glen.]

The obvious adjustments to start with are Steering Ratio and Linearity. The former may be set (from the Car Setup menu) differently for each track; the latter is a "global" adjustment (from the Options menu). Steering Ratio determines how quick the steering is, from lock to lock (full left to full right). Linearity determines how sensitive the steering is around TDC (Top Dead Center, or straight ahead). Since joysticks don't have as many degrees of travel as most steering wheels (usually about 70 degrees, vs. 120 to 270 degrees for a wheel), the steering would feel too "nervous" around the center point unless you moved the slider to the right (towards Non-Linear). The rule of thumb here is to set the steering lock first, and then, if the car feels twitchy in a straight line, move the slider towards the non-linear side. This is a matter of personal preference.

Four Wheel Drift

Alison Hine says, "I like the steering to be relatively slow so that I am less likely to unsettle the car." In other words, if you sneeze.

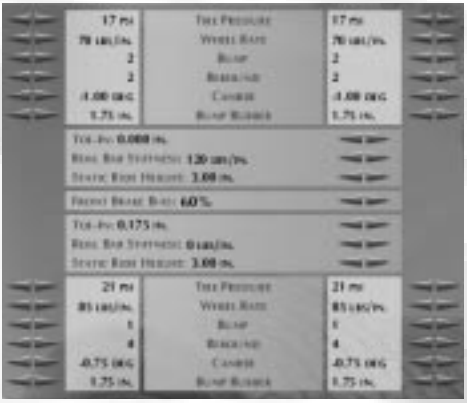
Fill 'Er Up?

The next adjustment I make is to the Fuel Level. Eventually, you will want to make sure you've driven the car with a full tank of gas before you start any event but a Novice race. For now, you only need a few gallons to try out different setups for a couple of laps each, but the danger is that if you save such a setting, you may forget to add enough fuel to make it through a full race, so I always add the amount to the setup's file name (viz., "Monza_25G," or "Monza_41L" to indicate the "DTE" or distance to empty, in laps). In an era before fuel cells (they did have bladders), it is almost inconceivable that the regulations allowed the cars to carry 300 lbs. of highly volatile aviation gasoline-the equivalent of something like 60 sticks of dynamite-and indeed, some horrendous fires resulted. Note the effect on Start Line Weight when you run the Fuel Level up and down. Less fuel will make the car accelerate more quickly, corner faster, and stop better.

You also need a rough Front Brake Bias setting, which will be further refined as we get closer to a final setup. Too much front bias will make stopping distances longer, but too much rear bias will make the car spin almost every time you stroke the pedal, so you want to start with it somewhere around 60% and worry about its final resting place (generally 56%-59%) when you're a lot closer to being "hooked up."

"Fixed" Values vs. Variables

So much for your initial settings. Moving on to the others, you'll find some numbers "locked in" by external factors, and some that are more appropriately variable. Let's start with the Wheel Rate. This is the individual stiffness of the four springs that hold up each corner of the car, so you can't reduce these values to zero, nor should you run them up so high as to obviate the compliance of the suspension in the first place. The value is determined by the weight of the car: the heavier the car, the stiffer (stronger) should be the springs. The Brabham is the lightest car in "GPL" (and has the smallest gas tank: 35 gallons), so its Wheel Rates should be softer (numerically lower) than the BRM's, which is the heaviest car in "GPL" (and has a 50-gallon tank). And all of these rear-engined cars are heavier at the back than the front, so the figure for the rear springs will always be higher than the value for the fronts.



[N.B. The Wheel Rates are given in pounds-per-inch of deflection, meaning that if a 150-lb. driver sat on the nose of a car equipped with a pair of 75-lb. front springs, the front end would dip one inch. It would take a 170 lb. weight to push the rear end of a car with 85-lb. rear Wheel Rates down one inch.]

The next item is the Roll Bar (or, more properly, anti-sway bar) Stiffness. The bars are lateral springs affecting the car's resistance to rolling sideways in the turns. Another of D.I. Arnao's many "rules of thumb" is that the value for the front bar (measured simply in lbs.; more precisely it should be ft./lbs. of torque per degree of body roll) should be about 10 lbs. higher than the numerical wheel rate-that is, a car with 70-lb. front Wheel Rates would take about an 80-lb. front bar. The setting for the rear roll bar is arrived at empirically, and is used to balance the car between "oversteer" and "understeer," but in practice, it usually winds up being about 70% of the front bar. Thus, in the example above, you'd use a 60-lb. rear bar (70% of 80 lbs., rounded off, as the bar may only be adjusted in 10-lb. increments).

Friends Don't Let Friends Drive Loose

Oversteer and understeer are European terms; the American terms are more descriptive: "push" and "loose." With the former, when you turn the steering wheel to get the car to make the turn, you find you need more steering lock than you'd estimated, because the front wheels aren't responding enough. They may even

"wash out," with the car plowing off the road nose first. This is serious front-end "push." Oversteer is when you crank in what you think is a reasonable amount of steering lock, only to find the car is responding too much-with the rear end coming around and trying to pass the front-and you have to ease off the steering so you don't spin out (or fly off the road tail first); the rear end is said to be "loose." For "neutral" handling, you want all four wheels to begin sliding at about the same time and to about the same degree. On a skid-pad, where you can crank in a fixed amount of steering, this is pretty easy to achieve. In the cut and thrust of racing, you may find your car understeers going into the turn and oversteers at the exit. Or vice versa. Or understeers with the throttle closed and oversteers with it open. Or any other damn combination you can think of.

In trying to achieve the right balance for the car, you may find it helps to take the bar adjustment to extremes, to dramatize the effect. (Bar values close together tend toward oversteer; spread apart tend toward understeer ... assuming you don't set the rear bar higher then the front, as you shouldn't.) Almost all suspension settings are a trade-off: softer gives more grip, harder gives more feel. If you soften the rear bar (by making it numerically lower), the rear wheels will have more traction, but the car will be harder to drive because the rear end wallows. If you stiffen it (numerically higher), you will have less traction, but the car will be quicker to react. You can try this yourself: do a few laps with the rear bar set full-soft (the lowest bar setting is 40 lbs., although you can disconnect it altogether, in which case the value shown is zero), then a few more with the bar set full-stiff. If you don't feel any difference, don't quit your day job.

Stiff feels more racy, more like most people's idea of the way a racing car should behave, because the car reacts quickly, nervously. But that isn't what you want. (Proof? Try taking the Vialone flat-out with the rear bar full-stiff. Bye-bye.) You want balanced handling, and to get that, you need to play with the rear bar until the car is neither pushing nor loose in the Parabolica with a "neutral" throttle (neither accelerating nor decelerating). Parenthetically, the right setup for Watkins Glen tends to be stiffer than one appropriate for Monza, because the Glen is banked and Monza is flat, as per Dr. Ing. Arnao's advice. After we've finished our business here, you may want to go back to the Glen and check that out for yourself.

Shocked, shocked!

The shock absorbers (or, more properly, spring "dampers;" they're called simply Bump and Rebound in the game; they damp out oscillations after the springs are

deflected so the car doesn't continue to bounce like a pogo stick after every turn or bump) are used to adjust the way the car responds to transitions. Another Arnao "rule of thumb" is that if the springs are stiff, the shocks should be too. I'm not so sure I agree. So many suspension adjustments are dictated by what must be that you don't have that much wiggle room to "tune" the car to your individual driving style. Basically, you've got shocks, toe-in, and differential settings, which I'll get to in a minute.

First, shocks. When a road wheel goes up in relation to the chassis "tub," the suspension is said to be in "bump" (or "jounce," as it's called in Blighty). When it goes down, the suspension is in "rebound" (or the more colorful "droop" on the other side of the Pond). The shocks respond to movements in both directions, but differently. Think of an ordinary household hydraulic door closer: it offers no resistance-except to the spring-to the door being opened, but hisses and sighs when you let go, as the fluid leaks from one chamber to another and the door swings slowly shut.

When you lean the car into a turn, the chassis wants to roll against the resistance of the springs. The Bump setting on the shock resists this at a controlled rate. (Same deal as the door-closer: hydraulic fluid spritzes from the top of the shock to the bottom through tiny valves.) Once you've stopped cornering, the energy stored in the spring is released, straightening the car up, and the fluid is forced the other way ... through a different set of orifices, the rebound valves. Thus, a stiff Bump setting makes for a faster response to chassis roll, and a soft Rebound setting makes for a smoother transition when the chassis rolls the other way. In general, you want stiffer Bump settings than Rebound settings, but you can only make a final determination after you've finished messing with the ramp angles in the differential (see below), because they too will affect the transition into and out of corners. Also in general, you want stiffer shocks at the rear (where there's more weight) than at the front, hence the notion that soft shocks go hand-in-hand with soft springs and v.v. I'd adopt a wait-and-see attitude with this, and for now leave the shocks set somewhere in the mid-range (i.e., about "3").

Toeing the Line

Toe-In (or, more properly, toe) is much more straightforward. To begin with, you never, ever, have any toe-out (or negative toe-in) at the rear, although at some tracks you may want some in front, to help turn-in. Passenger cars (which have neither toe-in nor toe-out at the rear) always have some toe-in at the front so you don't have to chase the car all over the road with the steering. It's a stabilizing force: in a straight line, the front wheels are aimed ever-so-slightly toward each other, making the car track in a straight line. Otherwise, the front end wanders. In a race car, you're presented with the usual Hobson's choice: if you run zero toe, you get less rolling resistance...but less stability in a straight line.

Four Wheel Drift

It gets more complicated when the front wheels are deflected to "pull" the car into a turn. With toe-in, no matter how much you turn the steering wheel, say to the right, the inside road wheel is "fighting" the outside road wheel. That is, the inside wheel isn't entirely with the program; it's still pointed a little bit more to the left than the outside wheel. With toe-out, on the other hand, the inside wheel is trying even harder than the outside wheel to make the turn (even though it has less traction), thus reducing understeer, or "push." This is not a good way to balance the car, however, as too much of a good thing will make the car wildly unstable in a straight line.

[N.B. The reason you don't want any toe-out at the rear is not only that the car will weave down the straight like a drunken journo after a binge at The Inkwell, but also-since you can't steer with the rear wheels-you have no control over the effect: the inside wheel will always be trying to steer you off the track. You want a few clicks of toe-in at the rear, but this is also not the way to balance the car. Make the big changes with the rear bar, and vernier changes with toe.]

If you've noticed that all these adjustments are interrelated (you can't change one without affecting another), you ain't seen nothin' yet. The two most closely related settings are Static Ride Height and Bump Rubbers, and you must move them together or suffer really unpleasant consequences.

No "Low-Riders" Please

In general, you want the car to ride low, as close to the ground as it can, to minimize lateral weight transfer (i.e., to avoid overloading the outside tires and underutilizing the inside tires). But if you get the car too close to the ground, the tub will scrape along the track with a horrible grinding noise, and you'll either lose steering control or traction at the rear, depending on which end "bottoms" first. This is easy to fix: raise the Static Ride Height, or stiffen the springs (reducing overall wheel travel), and/or the shocks (lengthening the time it takes for the wheel to go into full bump/jounce), until you no longer hear the noise.

However, there are other times when the car feels like it's bottoming out ... only you hear no noise. The car will seem stable enough on initial turn-in, but then snaps abruptly into over- or under- steer. If you've been running the car low, you've probably bottomed out on the Bump Rubbers. These are little auxiliary springs-they look like rubber cones-that prevent metal-to-metal contact when the suspension travel hits full bump ... hence the name. If you make them very short, they will come into play with a bang. You can soften the effect by making them very tall ... but then you have to raise the Static Ride Height, or you'll be cornering on the bumpers, something you never want to do. Again, the cure is simple: raise the SRH, fit stiffer springs, shorten the Bump Rubbers, or any combination thereof.

Like looking "outside the box" for spring and bar rates to better suit an individual cir-

cuit, decisions about the ride height and bumper settings are made on a track-by-track basis and will be discussed in the next chapter.

What's the Diff?

Now for the drivetrain adjustments-just hit one of the little gold arrows (or "Page 2!," as Paul Harvey might say). This is the nitty-gritty of "GPL." Not the Transmission and Final Drive Ratios-everybody's got them-but the differential settings, something never seen in an auto-racing sim before. Every car in "GPL" has a so-called limited-slip differential, which "locks up" (and becomes, functionally, a "spool" axle, with both wheels tied together as if there was a solid axle between them, not a differential) when one rear wheel...almost always the inside...loses traction and starts to spin freely. If the diff architecture allows this to happen, all the engine torque will be dissipated, and you'll be sitting there wreathed in tire smoke and the engine revving like mad...only you're not going anywhere.

Like almost everything else in this chapter, the devil is in the transition from one "state" to another; in this case, from an "open" diff to a "locked" one. It isn't "digital," all on or all off; it's a gradual transition. Just how gradual depends on two settings: the Ramp Angle (there are two, actually; one for power-on, one for power-off) and the number of Clutches. The Ramp Angles determine how abruptly the clutch-pack is engaged (the lower the number, the faster), and the number of clutches determines how tightly the rear wheels are locked together (the lower the number, the more loosely). If the acceleration, or power-side angle (the first figure of the pair) is low and the number of

clutches high, everything will seem fine until the engine torque overcomes the ability of the car to transmit it to the ground, at which point the outside wheel will break free (it will start spinning along with the inside wheel), and you'll get sudden, violent oversteer. If the power-side angle is high and the number of clutches is low, the transition from tracking around the corner to losing control will be far more mellow, and you'll get plenty of warning from inside-tire wheelspin before both tires break loose. Newbies will want the latter setting. I still do.

The deceleration, or coast-side angle (the second number) comes into play when you get off the throttle. If you have a high ramp-angle and few clutches, the brakes will behave normally (except that you don't want to brake while turning or the inside wheel will grab, sending you into a spin). It gets interesting with lower angles and more clutches: since you've tied the rear wheels more closely together, you get a primitive form of rear-wheel-only ABS (Anti-lock Braking System) effect, where one wheel can't lock up by itself. You can actually get shorter braking distances this way, with or without Brake Help. The conundrum is that while the power- and coast- sides of the ramp angles are separate, the number of clutches is an absolute (you can't have more on one side, less on the other), so this value is a compromise. If you want to err on the side of caution, I'd pick a smaller number of clutches (more like one to three than four or five).

Another rule of thumb: the heavier the car, or the less its low-end torque, the greater the number of clutches it needs ... or wants. Thus, the Brabham, a lightweight car with gobs of torque, may be undriveable with more than one clutch. The Lotus, maybe two. The BRM, a heavy car with an anemic low-end, can use all five. Short of wheelspin, the more clutches, the more understeer (when you apply power, the rear wheels try to push the car straight ahead). But, as Alison Hine puts it, "if you
feed in enough power to break loose the outside wheel, you're going to get power-on oversteer no matter what. Too much locking aggravates this; [almost] any amount of throttle and the outside wheel spins, causing snap oversteer. Too little locking and the inside wheel spins. In a correctly adjusted diff, the locking effect is set so that the inside wheel will start to spin just before the outside wheel is overcome by engine torque."

[N.B. Alison Hine uses the tire temps to help adjust the differential. Taking a reading coming off the Parabolica-where you're most likely to get wheelspin-she looks at the temp of the inside (RR) tire. If it's higher than the outside tire temp-which would normally be the hotter of the two-she knows she's spinning the inside tire, and adds a clutch or two until the temp drops. She knows she's gone too far when both tires break loose together, sending the car into snap oversteer. Then she removes one clutch-the inside tire should now begin to spin just before the outside tire breaks loose.]

In Doug Arnao's view, the single overriding concern of any and all setups in "GPL" is to get the car to "accept the power," in his words, when you put your foot in it. The ulti-

mate "traction control" is, of course, your right foot (if that's what you're using for the "gas pedal"), but no matter how well the rest of your setup is working, it will all come to nought if you can't get on the throttle sooner rather than later.

Brake Dancing

Same deal with braking-the object of the exercise is not to break the wheels loose. Again, the ultimate braking control is your left foot (you're not still braking with your right, are you?), but I am in no way averse to getting some help from faux ABS. And, like all the other dependent relationships here, you'll spend a long time balancing the diff settings against the Front Brake Bias before you find a combination that works for you. The good news: once you get it right at Monza, you can use pretty much the same ramp angles, number of clutches, and brake bias at most the other tracks...with the same car, of course.

One last brake tip: it is very easy, within one test session, to get "imprinted" like a duckling on your first shut-off/braking point, and it's needlessly frustrating to have to shuck the habit on demand. An easier way is to move the brake bias one click aft at the end of your last drive of the day. That way, the next time you fire up "GPL," you'll be starting afresh, and if the setting is one click over-center, you'll spin out before you get habituated. But even if it still isn't enough, you will at least be one click closer to perfection.

Got Gears?

The last, easiest, and most satisfying part of finding the right setup is adjusting the gear "splits" (or Transmission Ratios). Within limits, each gear in each car can be lengthened (for more speed) or shortened (for more acceleration). Or, if you change the Diff Ratio, it will affect all the gears at once. This is done by cut-and-try (although real-world teams have charts showing the effects of all the possible combinations).

So assuming you have a handle on the rest of the setup, you can now head out on the track for some gear testing. You won't reach your top speed between the pits and the Curva Grande, but if your tires are warm enough to see you safely through the Vialone (they take a lap or two to get up to their nominal operating temperature), check your engine's speed just before you brake for the Parabolica (you can also check your car's speed from the VCR replays). Hit "Escape," return to the Car Setup menu, and try another gear. You want a top gear that will just allow the engine to reach its redline before you have to shut off and start braking.

Next, try a next-to-top gear (G5 for BRMs; G4 for everybody else) that allows you to get all the way around the Vialone before you shift into high (this will also allow you to downshift for the Curva Grande). Try another gear that forces you to shift before the

tunnel; it will have better acceleration and you may prefer it. Third gear is critically important because if you get it right, you can pull strongly out of the first Lesmo, traverse the following straight without shifting, and pull strongly out of the second Lesmo ... so you want to get close to the redline between the two Lesmos (otherwise you incur two extra shifts, G3-G4 and G4-G3, which, if you ask me, is asking for trouble twice more per lap).

You'll go all the way down to G2 for the Parabolica (giving you a taste of faux ABS if you've got the coast-side locked up), but you don't want too short a gear here: it will slow you down going into the turn and give you wheelspin coming out. And no matter how finely tuned your diff settings, you will always have enough torque to light up the tires coming off the Parabolica, so I would recommend shifting well short of the redline here. Another way to choose a G2 ratio is to split the difference between G1 and G3 (which you can do by ear: the rpm drop between G1-G2 ought to be slightly more than G2-G3) on the way up.

Notice that you don't use G1 at all at Monza, except when leaving the pits. In fact, the only time you really need G1 is at the start of a race. Then, with all the cars around you revving their engines, when the green flag drops, you may not hear wheelspin (if you're getting any). So you might, if your interest is mainly in Hot Lapping, change the Diff Ratio to the longest in the game (10/31), and G1 to the longest available (14/32) for a 7.086:1 Final Drive Ratio). This would allow you to use G1 in the Parabolica, and to adjust the G2 ratio to give you better acceleration on the pit straight. Mmmmn, on second thought, maybe not. Sure, you want all the acceleration the right gears can give you, but, as Alison puts it, "any torque above the amount needed to spin the wheels is wasted," so don't make the intermediate gears too short.

One other thing about choosing gears-you don't want to have to shift in the middle of a corner. In the first place, this is likely to unsettle the car (if you're on the ragged edge), because you're spiking the torque. All other factors being equal, you want to hit the redline after you've gotten the car straightened out and are under full power. If you find you have to shift in mid-corner, try lengthening that gear.

Let's put it all together. Once you've finished tinkering with all your adjustments, you should take your car out for one last test run, save the setup, and call it a day. These are the things you should be looking for (in order of importance):

1. The Curva Grande. This is the most crucial turn at Monza because it connects the pit straight with the "bent" straight (della Roggia) that precedes the first Lesmo. When you get out of the throttle and on the brake the car shouldn't wobble, but more importantly, when you stop braking and start turning, you shouldn't have to make a lot of steering and throttle corrections, i.e., rolling smoothly back into the throttle should not cause any dramatic change in the car's line or attitude.

2. The Parabolica. Connects the two longest straights, but it's not as important because it's slow, and gaining 10% here isn't as worthwhile as gaining 10% in a high-speed turn. You should pay particular attention to how soon you can get back to a sustained full-throttle condition. You'll also want to try out different lines here because, later on, the AI cars will give you fits-passing you on the outside, for example.

3. The Second Lesmo. If you do well exiting this turn, you will carry extra speed all the way up the rise, around the Vialone, and down the back straight. Like the Parabolica, this will test your (and your car's) ability to get the power down.

And don't forget to check the tire temps one last time before you park the car.

Let's try the other tracks.

Monza's Curva Grande is without a doubt the most pivotal corner on the circuit. Make sure your car's setup meshes well with your approach to this turn. The key here is being smooth.

Chapter Five: Learning the Other Tracks

Now we come to a fork in the road. The young and the restless will want to move on and sample the other tracks. The older-but-wiser heads will want to start learning how to race at the tracks we already have under our belt, the Glen and Monza. Normally, I'd favor the latter. It's never made much sense to me to pick up the violin if the accordion proves hard to master, or to give up tennis after a couple of lessons in the vain hope that you may somehow already know how to play squash.

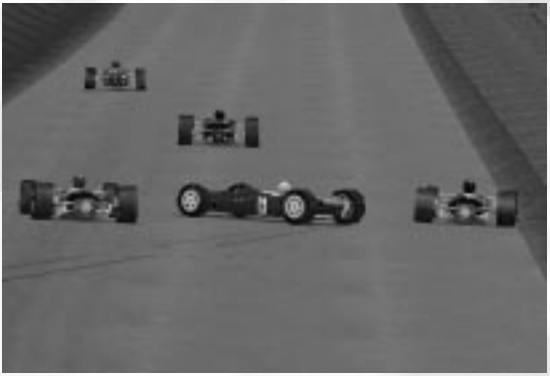
Just this once, let me side with those of you who can't wait to see what the rest of the real estate in "Grand Prix Legends" looks like, because it is impressive, and because being able to drive these historic tracks is the main reason a lot of you bought the game in the first place.

Here's what we're going to do. I'll lay out the other nine tracks in the order that makes the most sense to me. That is, we'll start off with Spa because your prior experience with Watkins Glen and Monza will prove useful there (Spa is high-crowned, like the Glen, and high-speed, like Monza). Then move on to Rouen, because what you've learned at the previous three tracks will benefit you there. And so on. You can rearrange the sequence in any order you prefer (maybe your father raced saloon cars at Zandvoort or whatever), and spend as much or as little
time as you want at each track. You can even hopscotch, backtrack, and repeat the courses you like. In other words: free-style. But bear in mind that eventually, if you want to contest the World Drivers Championship, you're going to have to learn them all, and take them on in the order they took place in the real world. We'll get into that in the next chapter.

Spa-Francorchamps

Spa-Francorchamps, in the deep, piney woods of the Ardennes forest in Belgium (near where the Battle of the Bulge was fought in WW II), is 8.76 miles of meandering country roads, remarkable mainly for being flat-out most of the way around. The average speeds are a wink short of 150 mph, making it the fastest track in "GPL." You'll spend a lot of time up near the "double-ton" (200 mph), marveling at how close the houses are to the road. The essence of Spa is the infamous Masta kink, a terrifying left-right rhumba-the old-timers claimed it could be taken without lifting; ha!-which you approach flat out in top gear, and wind up maybe six inches from somebody's front stoop. Spa's first turn, Eau Rouge, is considered by most experts to be the toughest corner in all of road racing. You plummet down a vertigo-inducing hill, feel your gut drop as you

hit bottom, then come roaring up out of the gulch, fighting for control as you get light again cresting the next rise, clawing for enough traction to make the lefthander that completes this notorious section. Thank goodness this is only a sim!



Irwin's BRM slides at Cottage as Lotus teammates Hill and Clark take evasive action.

There are a couple more thrills, too: full-bore downhill in fifth gear at Burnenville through a turn that goes on for half a mile before you have to get the car straight enough to stab the brakes and flick it in the opposite direction for a roller-coaster entry into blind, banked Malmedy (not to be confused with the present, wimpy Malmedy). Spa is still in use- Eau Rouge was recently restored to its former terrifying glory after having been saddled for years with a dolorous chicane- though shortened by half, and despite being infested with chicanes, is still one of the scariest tracks that modern GP cars race on.

For all that, Spa is surprisingly easy to learn, and will become almost everybody's favorite track in "GPL" (although not in real life; Clark hated the place). While long, there are fewer than a dozen major turns, and only two that are hard to master (Eau Rouge and Masta). By contrast, the Nürburgring is less than twice as long, but has ten times as many turns (none of which are easy; it's almost impossible to commit to memory; and has been truly mastered by only a handful of drivers since it was built in the '20s-Fangio's charge in the 1957 German GP is the stuff legends are made of).

As mentioned, Dan Gurney won the '67 Belgian GP in his Eagle, a car that was remarkably well-suited to Spa. The Weslake V-12 made almost as much horsepower as anybody else's, the car's high polar-moment gave it stability through the high-speed sweepers, and its light weight left it with plenty of grunt coming off the slow corners, like the last turn, the famous La Source hairpin. The Eagle would be my first choice in "GPL" as training wheels for this famous circuit. As usual, the Lotus is fast, but without all that many turns, much of the 49's advantage is neutralized here. In the actual '67 race, Clark did manage to put it on the pole with a 3:28.1, and led Jackie Stewart's BRM H-16 for the first dozen laps, until mechanical troubles dropped him to sixth at the end of the 28-lap race. In "GPL," the BRM H-16 has good mid-range acce-

leration, but lacks the ultimate top speed necessary to prevail. If you're looking for something different, you might try the Murasama, which handles Masta with grace and aplomb.

Let's assay a reconnaissance lap. Nowadays, the pits are back up the road, before La Source, but in those days, you started out halfway down to Eau Rouge, so your first time through this classic turn won't be anything like as scary as your first lap at speed. Make a mental note of the peak as you come up out of the dell; it's enough to get your car airborne, necessitating a throttle lift.

After reaching the highest point on the track at Haut de la Cote (a tight lefthander; the modern track peels off to the right here), you wend your way down a long, long hill. (Spa may be roughly divided into two parts: down the hill to Stavelot, and back up the hill to the pits.) About a third of the way down, you hustle through Malmedy, which is easier-and a lot more fun-than it looks. Another third and you thread your way through the dreaded Masta kink.

After Stavelot, you work your way back up the hill, through a couple of fast lefts and rights (Cottage and Quarry), and just about when you're finally wound out in top gear, you drop down a cog and power through the Blanchimont section before the pits finally reappear on your right. (These days, you'd be cranking through the Bus Stop chicane-a cut-out that really is a bus stop-but in "GPL," all you have to worry about is not over- or under- shooting La Source).

The fun begins on your second lap as you build up a head of steam rushing down towards Eau Rouge. Here's how Doug Arnao describes it:

"Get your braking done before you hit the bottom of the dip because you need to start turning right when the springs compress. Take a slightly late apex at the righthand part of Eau Rouge. Let the car drift outward slightly after the apex, then flick it to the left and take a late apex into the last corner of the series.

Graham Hill prepares to negotiate Eau Rouge in his Lotus. This left-right zig-zag must be taken smoothly, with precision.

"Turn in fairly early for Haut de La Cote. This lefthander is uphill, blind, and has some banking which will help you with an early apex. This turn has a great 4-wheel-drift feeling at the exit, so squeeze the throttle authoritatively, balance the car

on all four [tire] contact patches, and let it drift all the way to the right.

"Stay flat on the accelerator down the next [short] straight. Flick the car delicately into the lefthand kink, and almost immediately to the right. Just before you go under the [advertising-festooned pedestrian bridge], commit to the long, downhill turn through Burnenville, and keep the throttle open as long as the car stays on the inside path. Once the car starts to understeer out to the left, do a lift to point the nose back in, and finish the last part of this corner with a late apex."

Surtees stalks Rindt's Coventry through Malmedy. This view shows just how steep the drop really is!

As you exit Burnenville, straighten the car up, move over to the right, and stroke the brakes before you drop down a gear (or two) to set up for the first part of the Malmedy complex, a blind left, followed immediately by a blind, steeply banked right. Your aiming point for the righthander is a set of four flags at the apex. "Neutral throttle is the key here," says Doug, "so don't be too fast. As you swoop up out of this 'bowl' section, lift slightly for the following right," and don't get a wheel off on the inside of the following left. Even more importantly, don't hit the butt end of the stone wall at the head of the Masta straight. It's one hell of a wake-up if you haven't been paying attention.

"The Masta straight is taken flat-out in fifth, of course." You may just touch 200 mph here if you got a good head-start at Malmedy. "Move the car all the way over to the right as you blast down toward the kink. You will approach three sets of brake markers: 300, 200, and 100 meters. At about 150 meters, use the brakes to scrub off 30 mph or so, and flick the car gently into the first left of the kink. In one fluid motion, flick the car back to the right for a late apex, which should land you on the front doorstep of the two houses on your left." Congratulations-you've just survived the most dangerous turn in "Grand Prix Legends."

"You are now approaching Stavelot, a series of decreasing-radius righthand turns, all connected to one another. You will see three brake markers. Go all the way past the last one before you brake, gradually ease your car to the right for the first apex, then let the car drift back over to the left toward the billboards," as the road begins its long, uphill climb back towards the pits-you're about halfway through the lap. "What's important here," says

Doug, "is not to lose momentum going through Stavelot. You can do this whole section with no brakes at all when you get good at it; just let the car scrub off speed as the turn tightens, then squeeze the throttle back on for a slightly early apex for the final corner.

"A short uphill straight [leads] to a lefthand kink, taken flat out, followed by another straight leading to a tighter lefthand kink that must be taken with a small lift and a late apex. Stay to the left for the next turn, a sharper right, and mind your exit or you'll ride up on the berm."

Even though you're going uphill, the succeeding straight is long enough that you'll approach top speed again before the Blanchimont complex in the middle of the forest section. Get on the brakes hard and drop down at least one gear. The first two turns here are blind lefts. You can put a wheel off on the inside, but, again, the berms on the exit are steep, and if you put a wheel off at the exit, you will get "launched," as Doug says. After a blind right, taken without lifting, you blast up a short straight, lift again, and angle through the final lefthand kink. Blanchimont isn't all that hard, but you want to avoid "offs" at any of the exits.

You're now approaching the La Source hairpin (and on your right you can see the admin buildings towering over the pits), preceded by more yellow brake markers. Where you start braking will depend on how well you came off the last of the Blanchimont kinks, but you will need heavy braking and downshifting, all the way to G1. If you lock a wheel, you'll wind up in the haybales, so be careful not to ruin a good lap on the last corner.

Take a late apex, don't get wheelspin (remember, this is your first real hairpin turn; much tighter than the Glen's Ninety), and power down the hill past the pits towards Eau Rouge.

Are we having fun yet? Hoo-boy!

Setup Advice

Spa demands the stiffest setups in "GPL." One, because most of the time you're on a straightaway, not in a corner (as opposed to, say, Mosport, where you're bent into one turn or another for almost the whole lap). Two, because-La Source aside-what few corners Spa has are very fast (as opposed to, say, Monte Carlo, which-along with the Nürburgring-demands the softest setups in the game). You can't afford to wallow through the Masta kink; you need all the steering authority your setup can deliver. Thus, stiffer is better. Viagra, anyone?

Spa also requires zero toe (for minimum rolling resistance), fairly high tire pressures (ditto), and just enough ride height that you don't scrape the tub when you hit the bottom of Eau Rouge.

Rouen-les-Essarts

Next up: Rouen-les-Essarts, where, as mentioned, Gurney won in a Porsche in '62, the marque's only GP victory ever (as a factory entry). Also as mentioned, the real French GP in '67 was run at Le Mans (the Brabhams of Brabham and Hulme were 1-2), so no direct comparison is possible, but the race returned to this lovely 4.065-mile circuit in '68, after GP cars had started to sprout wings. (Stewart got the pole with a 1:57.3, but the race was won by Belgium's Jacky Ickx, in only his fifth GP with his team.) Rob Walker-himself an entrant, and Road & Track's correspondent-described Rouen as, "a true drivers' circuit, with some very difficult fast bends," but I've chosen it as our fourth training venue because it's also narrow like the Glen, with a stupefyingly slow hairpin, like Spa. It's also a bit more of a challenge than anything you've driven to date, with several compound corners where you have to sacrifice conventional wit and wisdom in the first part to ensure that you make the best exit from the last turn of the series, like the Esses at Watkins Glen.

Trouble in the hairpin: often times, the rear of the pack proves to be the most dangerous place to be. Here, only a lucky seven survive the scrum.

The most memorable feature of your reconnaissance lap will be Rouen's famous Nouveau Monde hairpin, at the end of a series of increasingly difficult zig-zags past the pits. You're rushing downhill here, and if you wait to start braking until you can see the hairpin, you're way too late. You have to start braking before a blind, lefthand kink, ease off the brakes to make the kink, then get back on the binders.

There's a lefthand 90-degree "elbow" (called Sanson) which I have yet to get right, a long, curving back "straight," followed by what looks like a turn-off to the right, after which you'll be headed back toward the pits, with only one simple righthander to go.

As you come across the S/F line for the first time at speed, you have to approach T1R timidly, backing off all the while (the car will run wide unless you get the nose down). You can't slam the car around here the way you can at some of the other tracks (like, say, Silverstone); you have to "finesse" the car all the way around the track. T2L is the same kind of turn, only slower. You then zig-zag back to the right for T3R and set up for the turn preceding the Nouveau Monde hairpin. Let beta tester Joachim Trensz describe it:

"T4L/T5R is a tricky combination. The problem is to slow the car down for T5R, the hairpin, without losing the rear end in T4L, and without overshooting T5R. It's best to [start] braking before T4L, get almost off the brake through it, then back on between T4L and T5R. And make sure you enter T4L on the far lefthand side. This will allow you to take a fairly straight line, and will give you room for correcting the inevitable rear-end slide under braking."

As you power back up the hill, there's a mild lefthand kink where you want to keep the wheels on the pavement at the exit. Then a brief run up to the Sanson elbow, another short blast (easy to get wheelspin here), another kink, and then you're tearing around the long back "straight," marveling at how the trees close to the road give a terrific impression of speed. It's like the Vialone, only it goes on and on and on.

The entry for T10R is vague. If you miss your braking point (easy to do), you can take a short trip up the "escape road," but not too far (another glass wall). From there, it's a piece of cake to stab-it-and-steer-it through the last turn before the pit straight.

Setup Advice

One good reason to sequence Rouen here is that once you have a setup you're happy with, you can use it as a good starting point for a lot of other circuits, like Silverstone and Zandvoort. That is, not too stiff, not too soft; not too much ground clearance, not too little; not too much toe...well, you get the idea. Even the gear "splits" should be middle-of-the-spectrum: you need a medium-ratio G1 for the hairpin, and a medium-ratio G5 for the back straight, etc. The hardest part to get right is the brake bias, because you'll be sorely tempted to give trail-braking a whirl here. Chances are, it will give you a whirl.

Mosport

Mosport is a great swirling bowl of energy, of suspensions stretched taut, of leaps of faith, of dizzying highs and gut-plunging lows. But never boring. Driving there is more like dogfighting in a WW I biplane than racing ... and it is one of the few tracks in "Grand Prix Legends" that is still active in its original configuration (more or less). It died as a major venue when the speeds of the Can-Am cars got so high
that they started to do back flips as they came over the pronounced hump on the Andretti straight (when air got under their chin whiskers). Today it seems poised to make a comeback, "under new management."

Located an hour or so east of Toronto in rolling, wooded hills, this 2.46-mile track hosted the first-ever Canadian GP in August of 1967 in the pouring rain (50,000 fans showed up). The press hype called it a "mini-Nürburgring" with some justification. There were few surprises: Clark put his Lotus 49 on the pole (with a 1:22.4), but after two

hours and 40 minutes (the lengthiest GP that year), Jack Brabham and teammate Denis Hulme had finished 1-2...again.

The track is a great equalizer. Its trickiest part is the double Moss hairpin (Road & Track's Henry Manney called the turn "diabolical"), but with all those ups, downs, and arounds, the drivers are busy the whole lap. The Lotus-Ford would be my first choice here because of its power and agility, but the Brabham is also well-suited to its roller-coaster ride. The long-wheelbase Eagle and Coventry feel predictably ill-at-ease. The Murasama and BRM are completely out-classed.

Dan Gurney's Eagle soars over the crest of the Andretti Straight. Mosport's (pronounced "Moe-Sport") sudden elevation changes can take their toll on a GP car's suspension.

The elevation changes begin the minute you pull out of the pits. You plunge down one hill into T1R, then swoop uphill for the first half of T2L and downhill for the second half. The lap goes on like that, with the sharpest downhill run bringing you to the hairpin (the first half of which goes up, the second half down), then up a mighty hill in the middle of the Andretti straight, over the hump, then down into T7R, a long righthander that reverses direction into the slower T8L, and back again into the even slower T9R just before the pits. This track has the second-highest "cockpit workload" of any in the game (after Monte Carlo); even busier than the Ring.

The hairpin aside, Mosport isn't a difficult track to get the handle on, but it does require many, many laps to reconcile what would be the right line if the track were flat with the extreme elevation changes. T4L, for example, starts off on the level, but then the road drops out from under you as you get light coming over the crest, and you have to fight to hold the car in (if you let it get away from you, you usually slam head-on into the end of a guardrail where a creek passes under the track ... also a danger in T8L).

You have to be exceptionally smooth in the first part of the hairpin (call it T5R-A) and preternaturally slow in the second section (T5R-B). The most difficult lesson for many novices is learning not to boom up over the hump, because doing so will leave you with no weight on the wheels to brake for the almost-immediately following T7R. Earlier, the downhill part of T2L (call it T2L-B) can also throw you off, literally and figuratively. There's plenty of

room here-and elsewhere around the track-for mowing the lawn...as long as you don't wrap your car around the end of one of the many ill-placed guardrails.

Setup Advice

Ginther plunges through the Esses at Mosport as the pack tries to keep up.

In a word: altitude. You want your car up on stilts. If you don't have enough ground clearance when the springs compress just before the Moss hairpin, bottoming the car will send you into a vicious spin. And it won't do just to stiffen up the springs to prevent the tub from scraping (or hitting the bump stops); you need a very soft setup because the car is teetering on the edge so much of the time. This is one instance when I'd go against Doug Arnao's advice and combine soft springs and bars with fairly stiff shocks. Adjust the rear bar to balance the car between under- and over- steer.

You'll also want to tinker with the gear ratios and limited-slip diff settings to be able to get the power down coming off all these twists and turns. You will go all the way down to G1 for the hairpin, and with light, torquey cars like the Lotus or the Brabham, no setup params will ever be an adequate substitute for "balloon footing." You probably won't ever see full-throttle in G1, unless you're trying John Wallace's whiz-bang spin-control gavotte (described in Chapter 3).

Silverstone

And now for something completely different. After the aerobatic swoops and Immelmanns of Mosport, let's look at Silverstone, which is flat as a flounder (having originally been the perimeter road of a WW II airbase-runways still criss-cross the infield) and has almost nothing like a sustained turn. As Doug Arnao puts it, "Silverstone doesn't really have corners so much as it has all these kinks. Once you figure out where the apex is for each one, you will start going very fast."

Silverstone (pronounced "Silva-stun" if you're trying to sound veddy British), halfway between London and Birmingham, has been through more changes than Jane Fonda. It was the site of the very first World Championship GP in 1950, and alterna-

ted hosting the British GP for 27 years with Brands Hatch. In 1967, Clark won the race from the pole (1:25.3) and set a new race-lap record (1:27). In the game, the 2.93-mile Silverstone looks touchingly bucolic, nothing like the urban/industrial sprawl it has become. The track remained more or less unchanged until the mid-'70s, when safety considerations dictated the usual infestation of chicanes. Copse, Stowe and Club are still recognizable, but the wonderfully fast Woodcote has been replaced by a maze of mind-numbing switchbacks (lugubriously yclept Luffield).

Jim Clark prepares to overtake a slow-moving BRM entry at Silverstone. Fast straights and a flat surface provide ample passing opportunities here.

Silverstone's layout is minimally interesting by "Grand Prix Legends"' standards. There are no compound turns-you simply accelerate out of one corner, upshift a couple of times, then brake, downshift a couple of times, and crank through the next turn. The approaches are all ruler-straight. You barely get into top gear. Most of the corners are constant-radius, neither increasing nor decreasing. Thus, it's kind of a "technical" track, like oval tracks in the U.S., where you learn the basics fairly easily...and then spend a lifetime trying to save a few hundred rpm or hundredths of a second. Nonetheless, Silverstone lends itself very well to racing with other cars (as opposed to racing against the clock), and you'll probably have some memorable dices here.

On your recce lap, you exit the pits after Copse (T1R at speed), and head south toward Maggots (T2L), one of only two medium-quick turns (Abbey is the other). I tend to back off too early here; the turn is both later and faster than it looks. The next two turns, Becketts (T3R) and Chapel (T4L) are the only pair that are even remotely linked. Chapel leads to the Hangar straight, the only place you'll see top gear. The next, Stowe (T5R), is a classic second-gear airport-circuit corner: brake and shift; accelerate and shift. Club (T6R) feels like the slowest corner; you might go as low as G2 here. Abbey (T7L) is definitely the fastest, and it's all too easy to run wide at the exit. The last turn, Woodcote (T8R), is a challengingly-fast sweeper with an ill-defined apex. Between each of these turns, you'll get up to G4 (except for the Hangar straight). With nobody to race with, "monotonous" doesn't begin to cover it.

Setup Advice

I'd begin by importing my Rouen setup here, lowering the car until you can hear the tub scraping on the road (then raise it a bit), and fiddling with the gear ratios (which should emphasize acceleration in G2 and G3). Again, you want to do everything you can to minimize wheelspin, because you'll be digging out of so many slow-speed turns. Finally, you can raise the rear bar (numerically) from your Rouen setup because you can afford a dash of oversteer here. That's about it.

Kyalami

From the time this 2.54-mile South African track near Johannesburg joined the GP schedule on January 2, 1967, it displaced Monte Carlo as the traditional season-opener. (The first of the year is the middle of summer down there.) The track has since been extensively modified, using only a small portion of the existing track (it's even run the other way around now: counterclockwise), but until 1985 it featured one of the longest straights in GP racing, although the top speeds didn't reflect it because the first third of the straight is uphill, and normally-aspirated engines are gasping for air at the track's 5,000-ft. altitude (only Mexico City's Autodromo is higher).

That first year was a bit of a disaster. One team didn't even bother going, thanks to the oddball scoring system (see next chapter), and all the hot favorites, including pole sitter Brabham (1:28.3) and early leader Hulme, wound up behind local hero John Love, who looked as if he was going to walk away with the race in an ancient 4-cylinder Cooper-Climax. Then Love ran out of fuel and pitted, handing the race to Mexico's Pedro Rodriguez in a 12-cylinder Cooper-Maserati (the marque's last victory in GP racing.).

In "Grand Prix Legends," there are no Coopers, but it's a fun track in front-running cars like the Lotus (which didn't actually appear until six months later; Clark and Hill drove 1966-model Lotus 43s powered by BRM H-16s in the race; both retired), Brabham (Jack and Denny also drove the previous year's models), and Eagle (Gurney likewise made do with an older, Climax-engined car; the Weslake V-12 still wasn't ready).

Jim Clark and Graham Hill lead the field at Kyalami in side-by-side fashion.

From the pits at the start of your exploratory lap, you're already over the top of the rise in the middle of the straight, so you simply boom 'n' zoom down the swaybacked part to Crowthorne Corner (T1R), a section tailor-made for passing-under-braking when you're ready to go racing. You arc up and over, run down a short straight to the whimsically-named Barbecue Bend (T2R), where you'll probably run wide on the exit. The sandy grass verge is as slippery as spit on a glass doorknob.

Kyalami features an interesting mix of fast sweepers and lazy bends. It may take several efforts to create a setup that can handle both types.

The only really fast turn is the next one: Jukskei Sweep (T3L), which will cause you to try a lot of techniques to get it right (lift, brake, shift, whatever). The subsequent Sunset Bend (T4R) is blind and lengthy, so plan on a late-ish apex. A short blast will bring you to Clubhouse Bend (T5L), a slow, tricky, off-camber turn which can be very frustrating if you're trying too hard.

The Esses (T6L and T7R) are tightly coupled, and a slight dip conceals the apex of the first and the entry to the second, but it takes little practice at speed to get these right. You're now going uphill again, up and around Leeukop Bend (T8R), which spills onto the main straight while you're fighting oversteer (more reverse camber). The only thing left is the Kink, which isn't sharp enough to cause you to lift, but is fast enough to send you up the sandy berm on the left if you get careless about your line.

At the beginning of your second lap, you'll notice the dip before Crowthorne has enough vertical curvature to force you to modulate the brake pedal if you want to get the most out of your brakes. You're still going uphill as you turn in (aggressively, please), which will hold you on the road as if it were banked, but the camber reverses at the exit. Usually you've scrubbed off enough speed on the entry that this isn't a problem, but it will become one as you get faster, so keep your tail tucked in. Also, as your exit speed from Crowthorne improves, you'll arrive at the seriously downhill Barbecue Bend faster than ever, and it is difficult to coax your car back onto the road if you slide off here. (I wish there was a sand trap-the barrier seems far away, but I've skated across the grass and into the fence more times than I care to count.)

Jukskei Sweep, as mentioned, takes some experimentation with both driving style and setup. This is a classic 4-wheel-drift turn and looks great in replays, but run wide and hit that dirt bank and you will go straight to hell. Both Sunset and Clubhouse require you to

be immaculate on the exits, as will Leeukop, but, as Joachim Trensz says, "the driving in general is easy at Kyalami...except for a few corners which tighten up at the exit." Just as an experiment, try driving the track the "wrong" way around, so these become increasing-radius turns. Easier, huh? (You'll be disqualified if you try these antics in a race, but there's nothing to stop you from having a little Multiplayer fun ... with human opponents, of course.)

Setup Advice

I would make your setup just "grippy" (soft) and "pushy" (understeering) enough to see you through the Kink with no problems, and expend most of your effort on optimizing your braking and acceleration. You might not want to go all the way down to G1 for Clubhouse or the Esses, but you do want to keep G2 and G3 close together (with G2 long enough to use all the way from Clubhouse to the Esses, like staying in G3 between the two Lesmos), then leave a gap to G4 for up the hill and (earlier on the lap) around Jukskei, and top it off with a fairly long G5. You don't need much ground clearance, and you don't want any toe at all, so as to minimize rolling resistance on that long, long straight.

Kyalami may not be the most exciting track in "Grand Prix Legends," but, like Silverstone, it's a great track for wheel-to-wheel racing.

Zandvoort

There have been only two great race-track designers in this century: Charlie Moneypenny (who used old railroad charts to calculate the right angle for the banking at Daytona and Talladega), and John Hugenholtz, whose masterpiece is the by-now-dilapidated Suzuka in Japan. Zandvoort-by-the-sea was one of his earlier efforts (dating from 1948), set in the sand dunes, and vaguely resembling the windswept Bridgehampton circuit on Eastern Long Island. Like Bridgehampton, many of this track's turns are both fast and blind, and there is a first-gear hairpin (which is more difficult than the one at "the Bridge," if you ask me).

The 1967 GP race at Zandvoort will be forever remembered as the debut of the sensational Lotus-Cosworth. Hill put one on the pole with a really hot 1:24.6 (a full six seconds faster than the previous year's pole, also taken by Hill), and Clark, in the second car, won the race and set FTD (Fastest Time of the Day) with a 1:28.1. After a year-and-a-half of promises, GP racing's "Return to Power" had finally become a reality.

I've had remarkably good luck here with the Brabham, which theoretically should be at a disadvantage on the two straights, but there you are. The Lotus can't be faulted on any count, including historical accuracy, and the long-wheelbase Coventry responds gracefully to the track's many surprises. Frankly, I've had little time in the Eagle, and even less in the others.

The broad hillsides obstruct a driver's view of many of Zandvoort's elusive turns.

Driving several laps at touring speeds is essential, because until you know which way the road goes over the brows of hills and around the blind turns, you won't know whether to be on the gas, the brakes, or even which way to turn. "The key to being fast at Zandvoort," says Joachim Trensz, himself a master of Hot Laps there, "is not to always be on the traditional line. Look for the best compromise that gets you through groups of corners the fastest." The first turn, called Tarzan (I don't know why) is easy enough; your troubles start with the next one, a humped left-right switchback, which, if you take the classic line, will leave you hopelessly crossed-up as you're getting ready for the Hunze Rug hairpin immediately behind the pits.

You meander up over a hilltop, follow a willowy "straight" over another hilltop (they all look confusingly similar) until you're dumped into an unexpected downhill right (Scheivlak), then up over a blind hill, around a blind left, out onto another circuitous "straight," over a little bridge, through a fast right and left, and over another rise, where you're suddenly presented with a tight, downhill right (Bosuit)
which leads to a proper straight past the pits. It seems to take forever, but it's only 2.61 miles. Like Mosport, it's a "rhythm" track, and if you're a good dancer, you can almost feel the beat.

Setup Advice

When I asked Achim about the "ideal" line, he scoffed. "It gets pretty crowded out there during a race. What you need to do is hang loose. I don't mean oversteer; I mean be adaptive: you need a setup that lets you make the best out of where ever destiny has put you on the track. This means, don't go for the very softest setup. I use a fair measure of springs and bars at the front and rear for the best car control [at the expense of grip], and diff settings that allow me to use the throttle to steer the car." And a touch of toe-out for good front end "bite" (because you can't afford too many "confidence" lifts to get the nose down). "Camber is important," adds Doug Arnao, "because the turns are banked a bit," so keep an eye on those tire temps (Scheivlak is a good place to take a reading). All in all, far from an easy
circuit to learn, drive, race, and/or devise a good setup for.

Four Wheel Drift

Mexico City

What can I say? I can't find anybody who loves this track in "Grand Prix Legends," but I can't find anybody who hates it in real life, either. It's an anomaly, schizophrenic. Half of it is wide open, free as a bird, soaring. The other half is pinched down, claustrophobic, as depressing as a minimum-security prison. Later named for the famous Rodriguez brothers (the aforementioned Pedro, and his younger brother Riccardo-motorcycle champion of Mexico at the age of 12; sports car champion at 15-both brothers were destined to die behind the wheel), the 3.11-mile Autodromo Nacional was the last race on the 1967 calendar ... and it determined the World Drivers Championship in Hulme's favor, even though the race was won by Clark, who also set the fastest qualifying time (1:47.56) and race lap (1:43.13), a whopping ten seconds faster than the old record.

When you first pull out of the pits, you think, hey, this is going to be great. But the first turn, which looks like a fast sweeper, gets tighter and tighter, then abruptly reverses direction and gets tighter still. A couple of short straights bring you to a 180-degree hairpin where you can see traffic coming the other way, like a 4-lane highway with a grassy median. This leads to what D.I. Arnao laughingly refers to as "the rhythm section," where you skitter hither and thither like a water bug on a bad surface-tension day. Finally, you're released onto another straight that leads to a steeply-banked righthander that looks like one-half of an oval track (or Riverside's infamous Turn Nine).

As usual, you can't hardly do better than the Lotus: it's got the moxie to handle the fast stuff and the agility to handle the twisties. Like the Brabham, it's got a little too much torque for its own good, so you have to feather the throttle through most of the switchbacks. It's not as bad as Monte Carlo and the Ring (see below), but it certainly doesn't favor big, heavy cars like the Murasama or the BRM. In real life, Chris Amon was second-fastest in qualifying (but his pit boss miscalculated the amount of fuel necessary to finish the 65-lap race), so you might want to double-check your fuel economy here.

Setup Advice

Minus the elevation changes, Mexico City is the same kind of track as Zandvoort, so whatever works there will work here ... minus some static ride height and a pinch of camber.

Monte Carlo

Monte Carlo is arguably the most famous Grand Prix circuit in the world (they tried a sports car here, once, in 1952; it was a flop). A "round-the-houses" street circuit that was first used in 1929, it has inspired imitations like Long Beach, Phoenix, and Toronto, but is now in a class by itself. "An anachronism, perhaps," says Guinness authority Peter Higham, "but it remains the glamour event in [Grand Prix] racing."

Jacky Ickx heads for Casino as Bruce McLaren's scowl fills his mirror.

The twists and turns of Monte Carlo (the town within the principality of Monaco, itself the size of New York's Central Park) are familiar to race fans around the world after years of heavy TV coverage (it gets the biggest audience for any GP race), and movies like "Grand Prix." Much of the circuit remains just as it ever was ... with a couple of painful exceptions. In 1972, a modern hotel was built over its famous tunnel, and a giant swimming pool was built over the track between Tabac and the Gasworks hairpin (which was moved farther downstream to accommodate La Rascasse restaurant), ruining the magnificent sweep of the Croisette, and forcing the drivers through four more turns and several more gearchanges.

In the movie "Grand Prix" (scenes for which were filmed during the actual 1966 race), it was claimed that the drivers had to shift 26 times per lap, or 2,600 times during the 100-lap event, which often exacted a heavy toll: there were only four finishers in '66 and the race was shortened to 80 laps from '68 onwards. In 1967, the course measured 1.96 miles, and Brabham put his car on the pole with a 1:27.6, an average speed of only about 75 mph, making it the slowest track in GP racing, then and now. Hill and Clark, still waiting for their Ford-powered cars, drove older Lotii fitted with 2.0-liter BRM V-8s. Wily pro Hulme won in a Brabham, a lap ahead of Hill, but it was a joyless day, Lorenzo Bandini having crashed heavily at the chicane (he would die of his injuries a few days later).

The Brabham, as you might expect, is ideally suited to Monte Carlo, principally because it is so small and light. You are hemmed in everywhere, by buildings, walls, curbs, street lights, haybales, guard rails, the tunnel, even bollards (those stanchions you tie your yacht up to), plus the course itself is about as narrow and tortuous as San Francisco's Lombard Street. The Brabham's lack of mass makes it easy for it to change direction, and easy on

the brakes, although its lack of heft does leave it wanting for traction under power. Success here depends not so much on brilliant driving, but on not "buying the farm," and the BT24's elfin size helps a great deal.

Theoretically, the Lotus should also be good here. It's similarly small, nimble, quick; it has low weight and a low polar moment. The trouble is, it requires extraordinary amounts of patience, restraint, exactitude, and unswerving attention. Some cars just seem to drive themselves. Not the Lotus.

Unless you have something to prove, I wouldn't even bother with any of the other cars in "GPL," although the Eagle might have a fighting chance in a short race. (Don't forget, reliability and frangibility-the susceptibility to damage caused by the driver-are modeled in the longer races.)

The course itself has two basic components: up and down. You do the uphill part in two lunges, the first from the Gasworks hairpin to Ste. Devote, and the second continuing up to the big Casino at the top of the hill. Aside from a few thread-the-needle moments, a piece of cake. It's the downhill part that will give you fits. You do it in five short blasts, punctuated by unbelievably tight switchbacks: Massenet to Casino Square to Mirabeau to Station to Portier. At the bottom, you're at sea level plus a few feet (that's the Mediterranean on the other side of the seawall). You sweep through the curved tunnel, zig-zag through the Chicane (the hardest corner to get right), and around the Croisette (interrupted by Tabac) to get back to the Gasworks hairpin. It's a toss-up which is the sharper of the two, Station or Gasworks; my vote goes to the former (now called Loew's, after the hotel). Let's look at this in detail.

Starting from the pits (situated on a narrow peninsula between the run down to Gasworks and the run up to Ste. Devote), you can easily get it sideways even before the first corner.

The Monte Carlo streets aren't always the safest place to be- if you happen to be driving a GP race car!

Even if you've long since graduated from the Trainers to one of the Grand Prix cars, you can save yourself a lot of frustration by going back to one of the lower-powered machines for your orientation laps. Otherwise, instead of learning the course, you're liable to be banging off the walls. "Monaco requires bravery in some sections," as Joachim Trensz puts it, "and discipline and self-restraint in others."

As you get close to the top of the hill, note that you're surrounded by light poles. Getting a wheel off on the curbing will upset your car; the poles will kill it. The Casino itself is to your left at the top, but the lefthander (T2L) is called Massenet; it's the following righthander (T3R) that's called Casino Square (it's actually a traffic circle). These two are usually taken in G2. A bumpy downhill blast brings you to Mirabeau (T4R), a relatively easy G1 right (mind you don't ride up on the curb at the apex). The road tightens up here, getting narrow and squiggly as you close in on the Station hairpin (trains crossed over the course here eons ago), a turn so tight you can't hardly see the apex when you're right on top of it. ("GPL" allows you to momentarily angle the cockpit view about 45 degrees left or right, but this is better suited to checking for oncoming traffic when you want to regain the track after an off-course excursion.) You might as well stay in G1 down through the unnamed right, over the little bridge, and around Portier, the last turn before the tunnel.

The tunnel, one of the most distinctive icons in all motor racing, is followed by the Chicane (it has since been moved "upstream"), which-like many of its kind-is approached from the "wrong" side (in this case, the left), so you can draw a better bead on the exit, with less wheel-wrenching. You barely have time to catch your breath before you have to shift down G4-G2) for the Tabac turn (yes, named for a smoke shop). Then back up to G4 as you bend around the Croisette, and back
down to G1 for the Gasworks hairpin.

The pit "straight" arcs strongly around to the right as you get closer and closer to Ste. Devote. If you're really good, you can downshift abruptly, which will break the rear wheels loose and scrub off speed sideways. If not, you have to brake in little bursts, starting from the righthand side of the road, braking across the road in a straight line, getting off the brakes when you run out of road and turning in again so you can brake in a straight line again once you've wrestled it back over to the right. You will lose the most time to the AI cars here; even more than in the Chicane.

Setup Advice

As you can imagine, setup is critical at Monte Carlo. The biggest problem is that-no matter what you're driving-you'll have too much power and not enough grip. Until you've learned to effectively employ part-throttle almost all the way around the track, about all you can do, setup-wise, is simply not to use G1 ... and don't wind the engine to the redline, either. As for grip, you run smack dab into a paradox: real-world teams usually disconnect the anti-roll bars altogether on street circuits-where cars heel over the most-because bars reduce grip, something you cannot afford to give away at a place like this.

To maximize grip, you need a soft setup, but to stay out of the clutches of the light poles, walls, etc., you need a stiff setup for good steering authority. Catch 22. About

the only compromise that works for me is shocks stiffer in bump than rebound, with as many as two clicks of toe-out. (You know you've got too much toe-out when the car "hunts" all the way up the hill.) Without bars to balance the car (if you're going to lose one, make it the rear bar), you have to do it with the amount of rear toe-in. If the car is loose at all, you won't be able to get back on the power. If it's got push, you won't be able to make the turn-in for the hairpins. Catch 23? Basically, you want it dead neutral, or maybe a tiny bit of understeer, and then control the car's attitude with the throttle.

And a lot of ride height (which will force you to add negative camber as well). With all the bumps and grinds-not to mention soft springs-you don't want the car low. Don't worry too much about getting the tire temps equalized here; the physics are so chaotic that it'll never happen. You want a little extra negative camber at the front to get a better bite when you turn in (balance this with toe-in at the rear if you've disconnected the bar), and a little extra positive camber at the rear so that the tread is flat to the ground when the rear end squats under acceleration.

Monte Carlo is a "niche" event. Don't worry about being perfect here (although you need to be to compete successfully); almost nothing you learn here will apply anywhere else ... except maybe Long Beach or Vancouver. Oops, wrong series! Carry on.

The Nürburgring

The mother of all race tracks is, of course, the Nürburgring, 14.19 hairier-than-heck miles and 174 Wagnerian turns tucked away like a medieval kingdom in the moody Eifel mountains (and not all that far away from Spa-Francorchamps). It was built-as a race track-by the Weimar government as a sort of a WPA project, and remained mostly unchanged from 1922 to 1966, when a chicane slowed the cars at the end of the long, long straight just before the pits.

Doug Arnao, who's never seen the track in real life (it still exists; it's even open to the public ... if you dare), was astonished to discover that it's mainly tight second- and third-gear turns; the exact opposite of Spa's wide-open spaces. It doesn't have that many actual hairpins where you double back; it's more like downhill skiing ... except that at least half of it is going uphill (Ex-Muehle is as steep as Laguna's Corkscrew, only going the other way). Several of the Ring's turns are world-famous (the Karrusel has spawned a dozen imitators), and there are at least three places where the cars get seriously airborne-the name "Flugplatz" means airfield. And parts of the track are so remote, you could fly off the road and it would be hours before the track marshals found you.

A last-ditch effort was made to "sanitize" the track in 1970 (the "launching ramps" were planed off, etc.), but it was obvious that it could never be made safe enough, so the German Grand

Prix moved to Hockenheim (after it had been decimated by chicanes) in 1978. In 1967, the event fell between the British GP in July, and the Canadian GP later that August. It was a carbon-copy of so many other races that year: Clark won the pole (8:04.1), but Hulme won the race. In between, Dan Gurney's Eagle built up a 45-second lead (the track is so long that the competitors would get spread out and rarely see each other), but fell victim to another infuriating gremlin just two laps from the end.

Jo Siffert skillfully weaves his way through the countryside with others in hot pursuit. Try staying directly behind another car to learn your way around the 'Ring.'

Despite the Mutt & Jeff disparity in size, the Ring has more in common with Monte Carlo than any other track, and a car that's good around the bob-and-weave street circuit will do well around the endless undulations of the mountain track. Thus, my first choice would again be the Brabham; it's broad torque curve is wonderful here-you can almost throw the gearshift lever away ... if it weren't for that two-mile-long straight. Since the surrounding scenery doesn't seem in such threatening proximity as Monte Carlo, the Lotus is a reasonable second choice, even though it still demands rapt attention. I cannot imagine how Gurney manhandled that big ol' Eagle around here so well; whichever car you choose, look for overall balance and an ability to get the power to the ground.

There is no "learning" the Ring, per se. It's just too big. The best you can hope for is to recognize its "sections" ("Each has its own rhythm," as Joachim Trenz points out), which still outnumber the sheer number of corners on most other tracks: Hatzenbach (at about the 1 kilometer mark), Quiddelbacher Hoehe (2 km), Flugplatz (3 km), Schwedenkreuz (4 km), Aremberg (5 km, just before a bridge goes over the
track), Fuchsroehre (6 km), Adenauer Forst (7 km), Kallenhard (8 km), Wehrseifen (9 km), Adenauer Bridge, Ex-Muehle (10 km), Bergwerk (11 km), Kesselchen (12 km), the Karrusel (13 km), Hoehe Acht (14 km), Wippermann (15 km), Bruennchen (16 km), Pflanzgarten (17 km), Schwalbenschwanz (18 km), then about 4 km of straightaway, with the Antonius bridge in the middle (20 km) and Tiergarten just at the end (22 km). What? Your car doesn't have an odometer? Not to worry; Papyrus has put up little signs all the way around the track to tell you where you are. The only problem is that they're hard to see, even at 1024x768-pixel resolution; and even at a reconnaissance pace they really fly by.

I could drone on and on, describing each turn in detail, but I'd rather suggest two better learning aids. First, get a copy of "In Car 956" (see the "Resources" chapter), a documentary made in the mid-1980s, where British enduro specialist Derek Bell blasts around many

of the world's last remaining great circuits (the Ring, Le Mans, Spa, Brands Hatch, and Kyalami among them) in a Porsche 956 sports car. With the camera running, Bell turned the fourth-fastest time ever recorded at the Ring, 6:41.2, and you will be riveted every inch of the way. Compare that with the fastest lap in the '67 GP (Gurney's 8:15.1), or Juan Manuel Fangio's astonishing fastest lap in 1957 (9:17.4). Second, point your browser to www.cbsgi1.bu.edu/bmw/nurbcgi.html, an amazing Web site where you can view detailed maps of the track, section by section, complete with the preferred racing line. (Let's just hope it's still there by the time you decide to pay it a visit.)

Then just keep on lashing around and around the Ring until it "emerges" (as Jerry Brown used to say). Section by section it will reveal itself to you. You can't miss Flugplatz or the Karrusel, and you'll easily recognize the "little Karrusel" at Schwalbenschwanz, the "yump" at Bruennchen, etc. Those who really know the place learned it one leg at a time also. When you finally see the gloomy old Nurburg
castle off to your right, you'll be like a horse heading for the stable-galloping heedlessly along the straight-but watch that 180-mph lefthand sweeper after the Antonius bridge, it's the only really fast turn at the Ring...and the fastest corner in "GPL."

Setup Advice

The same setup advice that applies to Monte Carlo applies here, except that you need a G4 taller than your G5 at Monte and a G5 that will let you get within earshot of 200 mph (i.e., a top about the same as what you're using at Spa). Also, regardless of what the real-world teams do or don't do, I wasn't about to disconnect the bars just because most of the turns are slow-they're G2 to G4 turns at the Ring vs. G1 to G3 turns at Monte Carlo. Still, I'd go easy on the bars and soft on the springs. "If I were you," says Achim Trensz, "I'd experiment with fairly soft shock settings; this makes the suspension more sensitive than using high values." Just be careful you don't "go to ground."

Jim Clark has plenty of company on either side at the Ring, as indicated by his populated mirrors.

With a suspension this soft, and facing jumps that would make a Ranger HALO team freeze at the door, you've got to raise the ride height close to the limit and learn to live with the weight transfer ... and bigger camber changes under acceleration and braking. How hard you're willing to land (remember: someday you're going to be racing with Realistic Damage) will determine how tall to make the

bump rubbers. My advice: raise ‘em high.

Don’t forget to crank in a click or two of toe-out at the front. It won’t be any fun on that long straight, but the other five-sixths of the lap will be much easier. (And since-unlike Monte Carlo with no rear bar-you don’t have to balance the car with the rear toe-in, you can increase that value to a more normal figure.)

Finally, the diff settings will be like whatever you used for Monte Carlo, with maybe one more clutch, since you won’t be dealing with quite as much torque multiplication. This will be more dependent on which car you’re driving than what setup you’re using (a heavy car can take more locking under acceleration than a light car). Balance this against brake bias, bearing in mind that you don’t need much brakes at the Ring, just a dab here and there (with one or two colossal exceptions). As always, the name of the game is getting the car to “accept” the power ... on a track where you’re going to be using the throttle a lot to
“point” the car where you want it.

Spring break. See you at Monza in two weeks.

Chapter Six: Going All the Way

It's show time. You've learned to drive the cars. You've learned to tune the cars. Now let's learn to race the cars. We're going back to Monza for some more basic training. Why Monza? For starters, you already know your way around the place. And because it's wide, with plenty of room for you and the AI cars to go wheel-to-wheel, side-by-side. And because, unlike the Glen-where the first three turns are close-coupled ... and only a few yards from the S/F line-the first turn at Monza is far from the grid, and nothing like as sharp as the Glen's Esses, so the start of a race at Monza is considerably less hairy; easier, in fact, than at any other track (even Kyalami and Mexico). And finally because, unlike, say, Spa, the grid is on the level, so you don't have to learn to hold the car with the brake while preparing for a jackrabbit getaway.

Besides, many of the other tracks require specialized skills. It's really hard to find a place to pass at Monte Carlo, for instance. Rouen is narrow. Mexico's "rhythm section" can get awfully crowded, as can Mosport. You can run a dozen laps at the Ring with a full field and never see anybody (and you only get pit signals every nine minutes or so ... when the information is already nine minutes old). And the Glen's high camber means it's hard to pass under braking because you have to do it on the diagonal (the AI cars don't seem to). The easiest tracks to race on, in my opinion, are Monza, Silverstone, Kyalami, and Spa, in that order. So we'll start with the easiest of all.

Choose your weapon. Since you're bound to be distracted by the presence of other cars trying to whup your butt, you don't want the added complication of constantly having to modulate the throttle (au contraire, you'll be champing at the bit to put the hammer down ... hard), so pick a car without so much low-end torque that wheelspin will be a problem. This would suggest the BRM or the Murasama ... but the BRM has an extra gear to deal with (another unnecessary complication), leaving the Murasama. If you've learned to love the Coventry, it'll do. Don't agonize here; these are training wheels, nothing more ... for the nonce.

Change from the Training mode to the Single Race mode, select a Novice race at Monza, and hit the bricks. You've got to be ready to boogie the minute you enter the 15-minute Practice session because the clock is always running (except when you hit the "Pause" key). This means you should have already spent as much time in the Training mode as is necessary to get your ducks in a row. Let's back up a bit and see what this means.

There are no separate qualifying sessions (as there are in American oval-track events

and modern Grand Prix races); your best time in "GPL"'s Practice session(s) will determine your place on the starting grid. These sessions range from a single 15-minute practice for a Novice race to a pair of two-hour sessions preceding a full-bore Grand Prix. Eventually, you will want to qualify on the front row-if not the pole-but don't worry about that just yet. You will also eventually want two distinctly different setups: one "Hot Lap"-style qualifying setup, and a more conservative setup for longer races. The Novice races are only 8% of a full-length GP; the Intermediate races are 15% and 30%; the Grand Prix events range from 15 laps at the Nürburgring to 108 laps at Watkins Glen. A Novice race at Monza is six laps. But you don't need separate setups just yet, either.

The Biggest Mistake of Your Career

For Novice races you need a single setup, with 5 gallons of fuel-perfect for 15 minutes of practice or about 10 minutes of racing. Before the race, use a Training session to work on a 5-gallon setup, and save it under a distinct file name like "Monza_5G" or "Monza_8L" (to indicate that it's good for about eight laps), and **THIS IS IMPORTANT!**–Make sure you also designate this setup as your racing setup, or else you'll start your first race with the default setup, which may include several hundred pounds of fuel you don't want and settings you've never practiced with. You'll be dead slow, spin out at every corner, think you've lost your mind or your chops or both, and may be in grave danger of suffering an immediate aneurysm. Ignore this advice at your peril.

Your Novice race setup should be on the stiff side, because good feel and driveability are more important than either grip or speed, at least at first. Unless you've got freon in your veins, you'll be extremely nervous in your first few races. You want a stable setup with a lot of feedback so you're less prone to making stupid mistakes. Later, you can trade some of this caution for some grandmaster flash, but for now, play it safe.

Another thing: go directly from driving the Training session with your 5-gallon setup to the Novice practice session, while the rhythm is still fresh in your memory, and because-as I say-the clock is always ticking, so you don't want to waste any time getting comfortable with your Practice setup. (This will hold true as you progress to longer races-use a preceding Training session to ensure a fast start in your Practice sessions.)

The first time you enter a Practice session, it will be a shock to see other cars all up and down the pit lane, revving their motors and ready to do battle. You'd be well advised to choose a small number of Opponents (from the previous menu); the minimum is five. Less intimidating ... and your frame rate won't suffer as much as with a full field of 19 other cars.

Four Wheel Drift

Don't wait. Snick your car into G1 and burn rubber towards the Curva Grande. Your frame rate will also benefit from your being the first car out of the pits-the fewer the number of cars near you, the smoother the animation.

Don't try to be fast on your first lap. You need at least a lap to get your tire temps and pressures into their proper operating ranges. "Grand Prix Legends"' lead designer Matt Sentell deliberately provokes wheelspin as he leaves the pits to put some heat in the rear tires. Just don't overdo it. Also, flog the car intermittently as you exit each corner, goosing the throttle to yank the car sideways-briefly-and backing off almost immediately to regain car control. This will not only heat up the tires, it will also give you a visceral indication of how much traction you have to play with. It also makes you look and feel tough, snapping and snarling like a pit bull.

How to Get to Carnegie Hall

This will be the drill for each and every Practice session right up through World championship events: get the car and yourself warmed up and settled, then establish a baseline. That is, don't start ripping off fast laps, you'll only lose valuable time when you spin. Start with slow, deliberate laps, with barely audible tire squeal; the kind of laps you could sustain all day long with no effort. Check your pit board. Once your times stabilize, narrow your eyes to slits, turn up the wick, go hell-bent-for-leather, and see if you can't sneak in a few fast ones. You will already have secured a position on the grid. Then-and only then-see if you can't improve on that position.

Once you get into the longer Intermediate and Pro races, the main change in your Practice procedure will be in working with two different setups: one omigawd Hot Lap-style setup for your best qualifying shot, and your actual race setup for what the name of the session indicates: Practice. Since it's easier to go from fast to slow than v.v., you'll start with your Hot Lap setup (with as few as 2 gallons), doing one warm-up lap and one ripper, then repeating the process until you've got a grid position you can live with. You won't want to spend the whole Practice session trying to improve your grid position, though, because you'll definitely want plenty of seat time with the setup you're going to start the race with (which could be carrying up to 50 gallons of gas). Another Never-Ever: Don't start a race with a setup you haven't practiced with immediately before the start of the race itself.

Qualifying Battles

You'll be tempted to stray from this advice by something Papyrus has modeled in "GPL": qualifying battles. Once you set a qualifying time you're happy with (or willing to live with), you can check back with the event menu and watch the other cars try to beat your time. If somebody posts a better time than yours, you can-if there's enough time left-re-enter the session and try to regain your spot. You figure it can't hurt (even

if you crash out, your old time will still be valid). In the real world, nowadays, the Big Dogs will wait until the last possible minute-until there's only enough time for an out-lap and the start of a hot lap-then go out and risk everything to get on the pole. The difference is that they have a "warm-up" session right before the race (qualifying is usually the day before) so they can check their race setup just before the big event. In "GPL" there is no warm-up session, so beware.

Something else you can do from the event menu is use the replay screen to hop into your competitors' cockpits and "look over their shoulder" from the in-car views. You won't learn much about the AI cars from this (you've seen one AI driver, you've pretty much seen them all), but it is fascinating to spy on your human opponents once you get hooked on multiplayer racing (see below). They can run, but they can't hide.

Still, with, say 10 or 15 minutes left of a longer Practice session, you're better off practicing with your race setup than trying to beat or learn from your opposition, real or AI.

You want to take care you don't quit a Practice session before the session "times out" (i.e., is complete), as indicated from the session countdown clock. If you do, all the times from that session are invalidated. If there's only one Practice session, the grid will be randomized for all the cars ... except yours ... you'll have to start from the very back of the grid. (If there are two sessions, the other's times will be used to determine grid positions.)

Once the session is complete, the game will advance to the next session or the start of the race. If the race is next, you will have an opportunity to go to the Car Setup menu and choose a different setup for the race (or make any last minute adjustments, like fine-tuning brake bias, although you rarely want to start a race with settings you haven't "proved" in practice). Once you enter the race itself, you'll find yourself on the grid with less than 30 seconds before the starter hoists the green flag. Then, after 3 to 7 randomly-determined seconds, he drops the flag and the race gets under way. (On a sloping grid, like Spa's, you'll have to hold the car with the brake or you'll be penalized for jumping the start-I'll explain the procedure in a minute.)

Four Wheel Drift

When the Tough Get Going

Now comes the hard part. You will be amazed at the start of your first race at how quickly the AI cars rocket off into the distance while you've still sitting there, spinning your wheels. Papyrus has accurately modeled the chaos and adrenaline-rush of real race starts. Even before the starter raises his flag, the other cars will be revving their engines like mad. When the flag goes up, so do the revs, rising to a fever pitch, and when it comes down, BOOM!, like a stun-flash grenade, you're on your keester, wondering where everybody went. This is perfectly normal. But rather than taking off to chase the long-gone field in vain pursuit, let's back up (again) and study the fine art of the quick getaway.

The big problem is wheelspin. If you think it's tough to modulate the throttle coming off a slow turn, it's nothing compared to getting cleanly off the line (or coming out of "the hole," as it's called in drag racing). Just like the rest of the racing "experience," you have to practice the starts ... over and over again. You don't want to do this in a Practice session; you could get shunted from behind. So-for each and every track-you want to devote a Training session to honing this skill. The way the guys like Doug Arnao do it is to snick the car into G1, depress the clutch (it can be on the keyboard or mapped to a wheel-mounted button), blip the throttle to raise the revs close to the redline, and pop your finger off the clutch. Almost as effective: wing the engine with the car in neutral, and punch the upshift button. (Once you move on to higher Damage Models, take care not to exceed the redline-you could scatter your engine.)

This gets you launched, but it doesn't help with wheelspin. That's up to you. (Okay, you can use Throttle Help, but your starts will be slower than a diesel running on used french-fry oil.) This is what you need time to practice. If you don't learn to feather the throttle, you may simply spin the wheels, or you may start to fishtail. Either, in a race, are "position killers;" you will fairly fly backwards through the field. And just when you think you've aced wheelspin and show up at the start of a race brimming with newfound confidence, you'll discover an even bigger problem: with all those cars around you making a racket, you'll be hard-pressed to hear your own wheelspin, so all those practice starts will have been for naught-because you will have learned to gauge wheelspin by ear.

Wrong.

Here's what you've got to do: turn the sound off (not just down) and practice standing-starts all over again, in golden silence. You can use the "F10" function key at first to get a bird's-eye view of tire smoke. You may consider carrying this procedure over to race starts (it's better at helping you spot anybody moving over on you than the cockpit view), but in the end you're better off judging wheelspin by watching the tachometer. If you see a "runaway" tach needle, back off and feather the throttle. If you simply cannot master this arcane technique, the only other approach is to shift into G2 immediately after you get launched in G1 ... but you'll still have to modulate the throttle in G2 ... it just isn't quite as difficult.

Don't Let the Sound of Your Own Wheels Drive You Crazy

Let's take some of the pressure off. Instead of trying to beat everybody into the first turn, let's start from the back of the grid, and simply try to keep the rest of the field in sight as they stream away from you in your first few racing starts. You can simply skip the Practice session and proceed directly to the race. You don't want a lot of competitors just yet. The front row is three-wide at Monza, so if you choose five AI cars, you'll be the only car in the third row, over on the right, in an ideal position to watch the starter.

The first couple of starts, just ease off the line and watch the competition become dots on the horizon. These are "throwaway" starts just to get you used to the "fog of war;" live-fire training exercises. As you get used to it, get more aggressive. If you get so crossed up that you have to come all the way out of the throttle (or, worse, spin), bail out (a Shift-R reset or just Retire); don't even bother trying to save it. It will come-bye and bye-you'll launch successfully and chase the field all the way into the Curva Grande.

Watch out! The first time you actually turn in, you'll forget that you're on stone-cold tires and you'll slew around like Pluto on a freshly waxed linoleum floor. You certainly shouldn't attempt any heroic overtaking maneuvers when you see the AI cars brake for this turn. Watch and learn. Repeat the process until you can ease around the Curva Grande and follow the field all the way to the braking zone for the first of the Lesmos. Sooner or later, you'll be able to keep the AI cars in sight for a whole lap. But if they pull away from you, take a DNF; you won't discover anything more than you've already learned droning around by your lonesome in solo Training sessions.

Meanwhile, Back at Monza...

When you're finally ready to skirmish with the AI cars, pick your spot. The most

likely place to nail a Tail-End Charlie is braking for the Parabolica. (The entry for the Curva Grande is too delicate for bold moves; the braking zone for the first Lesmo is too short.) Inside passes are almost always easier for newbies ... and the AI cars are notably feisty about being challenged by an outside pass. If they move over on you (and they may well), be prepared to yield rather than risk a collision. Not because car-to-car contact is bad (just don't lock wheels and get airborne), but because their spin-recovery will be better than yours, and if you wind up bounding through the sandtrap, it will take a long time to catch up with them again.

Once you're successful at a pass, you'll probably get nervous when you see the car filling your rearview mirror(s). But unless you make a bobble, chances are he won't try to repass you. Occasionally, a faster car will close in on you from behind. If he's come from out of nowhere, you probably won't be able to block him for long; he's faster and he will find a way around you even if he has to run you off the road (the AI cars actually model the aggression levels of individual drivers; aren't you glad Dale Earnhardt drives stockers?). But this shouldn't prevent you from trying. The AI cars are inherently tireless, relentless; but trying to block them is good practice for later, when you'll be up against HI (Human Intelligence, or humint, in spook-speak) cars.

Close the Door; There's a Draft: *One time-honored way of passing a competitor, silicon- or carbon-based, is the "slingshot." This involves "slipstreaming" (or "drafting," as it's called over here), when you rapidly close in on a competitor's tail-pipes at the end of a long straight. This will give you a little extra burst of speed, because his or her car is sucking a powerful vacuum behind it, and when you get close enough, the car ahead is also splitting the wind so you don't have to. You have to time it just right-you don't want to get too close too soon-but just before you both start braking, you can get enough of a "tow" to dramatically increase your closing speed. At the very last second, you whip out of the slipstream and let momentum carry you past. Of course, you may be going too fast to make the pass stick if you can't brake hard enough to make the turn. Either way, somebody's going to have bugs on their teeth from all that grinning.*

There are two other considerations for "slipstreaming." One, you'll need a slightly taller (numerically lower) top gear or you'll over-rev your engine (and maybe blow it). If you haven't factored this into your setup, don't draft during the race (except, maybe, early on, when a full fuel load will reduce your top speed). Two, slipstreaming can be used cooperatively as well as competitively. If you tuck in behind the other car at the beginning of the straight, it will make you both faster (adding as much as 5 or 10 mph by the end of the straight). Two cars can form a "drafting pact" during qualifying or a race to improve both their positions. Or you can attempt a "hostile" draft by tucking in behind a faster competitor. The AI cars don't seem to mind, but a savvy human driver will weave back and forth trying to "break" the draft.

Finally, when you feel completely comfortable running with the AI cars around you, like a scuba diver surrounded by a school of beautiful (if dangerous) tropical fish, you're ready to start racing for real.

Enter a Novice race and try to nab the pole position. Once you get serious about winning races, the pole position (it's always "coveted") gets more and more important as you increase the number of competitors. Bad stuff most often happens at the start of the race, and more bad stuff happens at the back of the pack than the front. Besides, in a short Novice race, you won't have enough time to fight your way forward. (And remember: the frame-rate, not to mention the view, is better with nobody ahead of you.) Lead from the front, as Sun Tsu might say.

There's A New Marshal in Town: *Unlike previous Papyrus auto racing sims, there are no full-course yellows (caution flags) which require the entire field to slow down and fall in behind the leader when there's trouble on the track. GP racing has never had 'em. Instead, if there's reason for a caution flag, you'll see one of the flag marshals displaying a "local" yellow immediately before the trouble spot. When the track is again clear, you'll see a marshal holding a green flag.*

You may also see a blue flag. This is an advisory, meaning there's a faster car behind trying to overtake you. Or a black flag. This means you did something naughty, like jumping the start, taking a shortcut, or driving the wrong way around the track. If so, you'll have to call at your pit for a timed "stop n' go" penalty ... or else you'll be disqualified.

The checkered flag means-thank goodness!-you've finished the race.

And you'll want to move up from Novice to Intermediate to Pro races (and maybe even a full-length Grand Prix; Kyalami is probably the least dangerous; a little over 200 miles in a little over two hours), and from Novice to Realistic damage. The next big branch in the decision tree is whether to take a run at the World Drivers Championship, or go racing online (almost all online races are quick 'n' dirty Novice or Intermediate events), or one of the other multiplayer options (one-on-one via modem or direct connect, and LAN racing, which I'll explain presently). We'll look at the Championship first, since that's more of a straight-line progression from where you've already been. (Racing against HI cars, as we shall see, is a whole 'nother universe.)

Four Wheel Drift

The World Drivers Championship

The oddest feature of the 1967 World Drivers Championship was the way it was scored. Traditionally, drivers would get 9 points for finishing first, 6 points for second, 4 for third, 3 for fourth, 2 for fifth, and 1 for sixth. That year, however, the season was split into two halves, with six races in the first half and five in the second. Drivers earned the same number of points for first through sixth places, but they had to discard the points scored in their worst race of the first half (the GPs of South Africa, Monte Carlo, Holland, Belgium, France and Great Britain), and their worst race in the second half (the GPs of Germany, Canada, Italy, the U.S., and Mexico). This was intended to prevent any single driver from building up an insurmountable lead early in the points battle and thus diminishing interest in the last few races. If the year had been scored the old-fashioned way, Denny Hulme would have won the Championship with 51 points, Jack Brabham would have been second with 48, and Jim Clark would have been third with 41. Scored the newfangled way, Hulme won with 51 points (the same), Brabham was second with 46 points (having discarded 2 points for his fifth place in the U.S. GP), and Clark was third with 41 (the same). So nothing was changed, and the system was abandoned the next year.

"Grand Prix Legends" faithfully models this oddball scoring system, and you might be able to get it to work in your favor. For example, I simply cannot imagine being able to complete 100 laps of Monte Carlo in the first half of the season, nor 15 laps of the Nürburgring in the second (the opportunities for disaster are just too numerous). If I was supremely confident that I could finish in the top six positions in the other nine races, I wouldn't even bother entering these two taxing events. But I suppose I'd want to, anyway ... just in case ("The others might lose," as Peter Ustinov said in the classic "Grand Prix du Roc").

Getting Your Mind In Gear

Like any other points-based Championship, in each of the eleven races, you have to change your mindset from the Single Race mode: you're not going for position, you're going for points. Sure, the top six positions pay points, but as you get close to the end of the season, you need to be more and more conservative in your approach. You shouldn't go wheel-to-wheel with just anybody for gold, guts, or glory (the way Ayrton Senna often did), you should only risk getting (or staying) ahead of whomever you need to retain your points lead. Say, going into the final race at Mexico, Clark's best 5 of the first 6, and 3 of the last 5 races have netted him 49 points and you have 57 (unlikely, but this is hypothetical). You don't have to win in Mexico ... or even have to finish. You just have to make sure Clark doesn't win (or, if he does, that you finish fifth or better ... if that isn't your worst finish of the second half). If he drops out, you can just cruise around waving to the cheering multitudes (the apres-race festivities at the Autodromo made soccer hooligans look like choir boys). You could even park it and

win the Championship. Just make sure you've calculated all the mathematical possibilities before the race starts; Mexico's notorious hairpin is no place to be figuring the odds in your head.

Probably the most important strategic decision facing you in your quest for the Drivers Championship is which car to drive. There's no point in choosing the Brabham for its reliability, however, if you're not comfortable driving it. Or the Lotus for its performance if you can't be consistent with it. (You can't switch teams in mid-season, either, although many drivers did ... and still do.) My sentimental choice would be the Eagle, but even if its reliability in "GPL" is *twice* what it was in real life, it still isn't good enough. Consider. Brabham and Hulme had one DNF apiece in their BT24s. Graham Hill had 8 DNFs in his Lotus 49 (Clark had 3, although his car was on the brink of collapse as he won the U.S. GP). Gurney had 8 DNFs in the Eagle, while sometime-teammate Bruce McLaren had a perfect record in the second Eagle: 3 DNFs in 3 starts. Not good.

Multiplayer Options

The World Drivers Championship is the highest challenge in "Grand Prix Legends." Serious stuff, requiring serious levels of commitment, concentration, consistency and intestinal fortitude. Multiplayer racing is just plain fun, rarely ever serious. It's the difference between making "Lawrence of Arabia" or shooting a home movie. My jaw tightens just thinking about the World Drivers Championship, but multiplayer racing elicits grins from just about everybody.

You've got four options for racing against human opponents. Two players can race against each other with a pair of computers connected directly (with a serial-port-to-serial-port cable), or over ordinary phone lines via modem. But if you've already got a modem, you've got the hardware necessary to hook up with as many as 20 players-theoretically-online; all you need is an ISP (Internet Service Provider). However, in practice, the Internet's well-known "technical difficulties"-latency, narrow bandwidth, stem-winding ping times-reduce this to maybe a half-dozen ... for now (the Net is getting better every day). Still, why race one-on-one when you can race one-on-many?

One-on-one makes sense if you've got two computers in your home. You can invite your racing buddies over, take turns bashing each other's brains out, everybody has a good time, and there aren't any connect charges or weird Internet anomalies. You could hook up your two computers with a null-modem cable, but you'll get better performance (and other, non-racing benefits, like file- and printer-sharing) if you hook up your own LAN (it uses the same TCP/IP connection protocols as Internet play). If you've got three or more computers at home, this is the only way to go ... and the gameplay is flawless. There are now 900-MHz wireless LANs so you don't have to "pull cable" through the walls of your house, and the cost per "node" is reasonable.

Your Best Bet is the Internet

Still, your best bet is the Internet. It's easy to find and race other "GPL" enthusiasts at almost any hour of the day or night. As beta tester Alison Hine points out, unlike NASCAR's legions (Papyrus' "NASCAR Racing" has sold-literally-millions of copies), fans of 1967 Grand Prix racing are bound to be few and far between, and the World Wide Web is the only practical way of getting "GPL" players together.

Just don't expect them to behave like the perfect gentlemen/sportsmen modeled in the game. There is no compelling reason for online strangers *not* to take outrageous chances. They're not going to get hurt. They're not going to get killed. They aren't going to do any irreparable damage to priceless vintage machinery. Many of them aren't above racing around the track the wrong way, trying to take out the entire field, if they think they can get away with it. No amount of experience racing with the well-mannered AI cars in the game will prepare you for the brass, bravado, and braggadocio of online players. That's what private racing leagues (password required) are all about. (There are also polite *offline* racing leagues like those sponsored by CompuServe's Sports Simulation Forum.)

But there's nothing like the thrill of connecting with like-minded souls for a little friendly racing online. I missed out on one such opportunity just this morning (too busy finishing this book), but here's the glowing "race report" filed by Alison Hine immediately thereafter:

"*KYALAMI, South Africa (June 27, 1998)*-Can anyone break the domination of the Hine team in the world's first international "Grand Prix Legends" series?

"Today's results did nothing to suggest otherwise. After some hard-fought battles, cars wheeled by Nate and Alison Hine won all three of the online races held at Kyalami this morning.

"Alison Hine [New Hampshire] took the pole for the first event, and won the race going away. Nate Hine [Vermont] qualified and finished second, while John O'Keefe [California] came home third.

"After the Hine team [brother and sister] passed on their latest setup information to O'Keefe, John put up a spirited battle for the pole for the second race, dominating much of practice, only to be pipped by a quick time from Alison in the final seconds of qualifying.

"Alison led the early laps, but slid wide at Crowthorne, allowing Nate and John through for the lead. The latter two battled mightily for the remainder of the race, until a quick spin by John in the last turn of the penultimate lap handed Nate the win and put

John in jeopardy of being passed by the hard-charging Alison. She was unable to capitalize on John's misfortune, however, and finished a close third.

"Despite difficulties with a malfunctioning shifter microswitch, Alison won the third race easily, several seconds ahead of Nate, while John finished a distant third.

"Other hoped-for challengers failed to materialize. Crack British contenders Mike Laskey and John Wallace were unable to resolve scheduling conflicts, while German Hot-Lap ace Achim Trensz was stymied by logistical problems. Urbane American setup guru Doug Arnao was also regrettably a no-show.

"Reasons for the failure of the heavyweight Papyrus team to appear are unclear. Speculation in the paddock is that Papyrus engineers lack confidence in their ability to be competitive at the world-class level, and stayed away to avoid humiliation at the hands of the elite beta test team."

Sounds like a lot more fun than racing against your computer, doesn't it?

Enjoy!

Chapter Seven: Resources You Can't Do Without

Here's where to get some of the stuff mentioned earlier in the book (plus some that isn't).

3-D Accelerators. There are a slew of 3-D accelerators on the market, but only two chipsets that will do anything for "Grand Prix Legends" (the Voodoo series from 3Dfx Interactive and the Verite series from Rendition), and only two manufacturers with which I have had unabashedly successful experiences: Diamond Multimedia Systems (www.diamondmm.com; 800-727-8772), which makes the Stealth II S220 (a Verite-based card), and a couple of Voodoo2-based cards (8- and 12-Mb versions); and Creative Labs (www.creativelabs.com; 800-998-5227), which also makes 8- and 12-Mb Voodoo2 cards, as well as a splendid line of ISA and PCI sound cards.

"American Grand Prix Racing," by Tim Considine (Motorbooks International, 1997). If you're a native of Upper Volta (sorry; Burkina Faso), this book might not have much resonance for you, but it's a must for a Damn Yankee like me. American drivers in American cars have won only two Grands Prix in this century, but we've produced a pair of World Champions-Phil Hill and (the naturalized) Mario Andretti, as well as a covey of world-class GP drivers to swell our national pride; Masten Gregory, Richie Ginther, Ronnie Bucknum, and Peter Revson among them. Their stories are well documented here by child-actor-turned-car-buff Considine (whom you may remember from the TV series "My Three Sons"). Available from Classic Motorbooks.

Classic Motorbooks (www.motorbooks.com; 800-826-6600). The mother lode! If you're a car guy, you've probably been on their mailing list for years. If not, do it now. The greatest single source for automotive books in the known universe. Not all of it is racing-related (endless pages in their catalogs are devoted to restoration, maintenance, shop manuals, buyers' guides, trucks, bikes, vintage police cars, farm tractors, barn architecture, fire engines, motor scooters, woodies, marque histories, automobilia, and the like), but they have all the competition books, technical tours de force, race-car preparation guides, etc. (at least the stuff that's still in print), plus videos like Steve McQueen's "Le Mans" and Claude LeLouche's "Rendezvous" ($49.95 for 7 minutes...and worth every penny), even a few collectibles like a perfect 1:18 Shelby Cobra Daytona Coupe.

"The Complete History of Grand Prix Racing," by Adriano Cimarosti (Aurum, 1997). A big, beautiful, coffee-table book with hundreds of historical photographs, track maps, tech drawings, car charts, abundant text, and-for some reason-autographs of almost every GP driver who ever turned a wheel. Indispensable if you're a fan of Grand Prix racing. Available from Classic Motorbooks.

Controllers. The be-all-and-end-all of race-car controllers (steering wheel and pedals) are the ones made by Extreme Competition Controls, Inc. (http://ourworld.compuserve.com/home-

pages/extreme; 612-824-6733), which look like they were built for Lotus, cost about as much, and deserve a place in the Museum of Modern Art's permanent collection alongside Dr. Ing. Ferdinand Porsche's Cisitalia.

But the People's Choice, by acclamation, is the Thomas Steering Wheel (http://soli.inav.net/~thomas/). It's as sturdy as a Sherman tank (and about as homely), costs a third as much as the ECCI gear (above), and, as far as I know, has never had a dissatisfied customer. I'm serious.

These are the only two I can recommend without hesitation, but there are perfectly acceptable (and more modestly priced) models available from ThrustMaster (www.thrustmaster.com; 503-615-3200) and CH Products (www.chproducts.com; 760-598-2518).

"Drive to Win," by Carroll Smith (CSC, 1996). The latest and greatest in a series of how-to-race books by Smith (no relation). Smith has been a Wrench to the Stars (Amon, Andretti, Foyt, Gurney, Hulme, McLaren, et alia) for decades, knows every trick in the book (and a few that aren't), and writes in a salty, down-home, easy-to-grasp style that will tell you more than you want to know about any topic from the storied "traction circle" to driving techniques to-hey Buffy, look at this!-how to mess with ramp angles and clutch-packs in limited-slip differentials. You may not always agree with him (he is nothing if not provocative), but you will learn. Available from Classic Motorbooks.

Game cards. Chances are your computer already has a game port as part of your sound card. However, you may want to consider a dedicated game card like the very advanced Lightning 4 from PDPI (www.pdpi.net; 805-581-7023), which was specifically designed for Windows 95/98 and online play; or the ACM card from ThrustMaster (www.thrustmaster.com; 503-615-3200), which has a manually operated sensitivity adjustment; or the CH Gamecard (www.chproducts.com; 619-598-2518), which has an automatic sensitivity adjustment. But unless you're a computer "expert" (self-taught or officially accredited) and/or are having specific port-related problems, I'd proceed with caution here.

"Grand Prix," (MGM, 1966). Director John Frankenheimer ("The Train," "Seconds"), himself a certified car nut, took a huge crew to Europe for most of the 1966 GP season, filming chunks of the World Championship races at Monte Carlo, Spa (including helicopter and in-car footage of the ghastly pile-up at the Masta kink during a sudden squall that took out the entire BRM team on the first lap), and Zandvoort. His cinematographer, Johnny Stevens, didn't have the ability to pan his cameras during the GP of Monte Carlo (so the camera isn't swiveling into the apex when you want it to), but used driver-operated tilt-and-pan mounts to good effect for the final race at Monza. The cars in the staged shots are clever counterfeits.

Jim Garner, driver of the BRM ("Jordan" in the film) and the Honda ("Yamura") went on to race real cars, as did Frankenheimer. Yves Montand (the protagonistic driver) reportedly hated cars and auto racing as much as Elvis (who made several car movies). I can't decide which is more irritating: Maurice Jarre's hook-heavy score (spoofed in Robert Altman's "The Long Goodbye") or moto-journo Bernard Cahier trying to steal more scenes than David E. Davis-lookalike Bill

Broderick. And who says the commercialization of GP racing didn't begin until 1968? "Grand Prix" looks like a 3-hour Goodyear infomercial. (To be fair, Akron paid a lot of the freight.)

"Grand Prix Circuits," by Alan Henry (Motorbooks International, 1997). Although this large-format book only covers contemporary circuits, there are four tracks which still have application to "Grand Prix Legends:" Monte Carlo, Silverstone, Spa, and Monza. None of these are the same as they were in 1967, but portions of them are, and the beautifully-rendered track maps do an excellent job of showing the proper racing line ("groove"). Monte Carlo, for example, has changed the least. Spa's infamous Eau Rouge has been recently been restored. Parts of Silverstone are still recognizable. And you can get an inkling of how far the once-heroic Monza has fallen since modern chicanery chopped it into baby food. Renowned auto-racing writer Henry provides some interesting historical insights. Available from Classic Motorbooks.

"The Guinness Guide to International Motor Racing," by Peter Higham (Motorbooks International, 1995). When the facts are in dispute, who're ya gonna call? Guinness, of course! The book's subtitle says it all: "A Complete Reference from Formula One to Touring Cars." It has stats from every Grand Prix of the modern era (from 1950 on), including the date, track, track length, laps, race length and time, average speed, fastest lap, pole position, front row, weather, and the points-paying top-six positions. Plus a summary of the year. Plus a chart showing every driver who competed during the year, what they drove, and where they finished (or DNF'ed). There are track maps, descriptions, and historical notes. Plus a drivers and manufacturers section (remember Frank Costin and Brian Hart's wooden-chassis Protos?). The best part: this profusely illustrated, 544-page work was being remaindered for $5.95, which means a new version (this edition covers up through the 1994 season) is on the way. Was available from Classic Motorbooks.

"In Car 956" (Powersports Video, 1987). You want to know how to drive the Nürburgring? This is how Derek Bell does it, babbling away like a tour-bus guide as he boots a Porsche 956 around the Nordschleife a good two minutes faster than you're ever likely to do it in "Grand Prix Legends." Bell, who's won every endurance race from Daytona to Le Mans at least twice, gives lucid explanations of how to get around not only the mighty Ring, but also Spa-Francorchamps (the new one, but he shows you where the old one leaves and rejoins the present circuit), Silverstone (so changed you'll barely recognize the place), Kyalami (the old, clockwise circuit), and Le Mans (when the 4-mile-long Mulsanne straight was longer than most modern race tracks). A must for "GPL" fans. Available from Classic Motorbooks.

The Internet. The trouble with this inexhaustible resource is that it's so ephemeral-pages, even whole sites, can vanish overnight. But as we go to press, there have been several sites devoted to "Grand Prix Legends" several months before its release. Papyrus has its own site, of course: www.papy.com, as does beta tester extraordinaire Alison Hine: www.alison.hine.net. And many of the marques in "GPL" may be researched. Ferrari, for example, has a lovely site-a virtual museum of all their great racing cars, a gallery of historic racing photos, and a ton of statistical information. My favorite site is the one that has a multi-page map of the Nürburgring, section by section, showing the racing "groove" through each one of this fabulous track's 174 turns

(www.cbsgi1.bu.edu/bmw/nurbcgi.html).

There are online and off-line racing leagues, and discussion groups on America Online and CompuServe. We surfed and searched and found bickering user groups like rec.alt.sims, vendors, FAQs, hard- and soft- ware reviews, speed-trap tips (useful if you're on your way to an old-car meet at Watkins Glen, Elkhart Lake, Road Atlanta, or Laguna Seca), collectors, online gaming sharks ("Race you for pinks!"), and a loose federation of old-car guys...and so can you. All it takes is time and an ISP.

Lotus 49-Ford DFV (Exoto; www.exoto.com; 800-872-2088). You may not be as prescient as Washington's Pete Lovely, who paid $36,000 for a year-old 49 in 1968 (he still has it; it's worth millions), but I paid one hundred dollars for one of these exquisitely-detailed 1:18 die-cast models and placed it atop my monitor when I started this project ... and my admiration for its craftsmanship (and Maurice Philippe's original design) has only grown since. Everything from the size of the 49's exhaust plumbing (it was huge) to the tread pattern of its Firestones is unflinchingly correct. Even the spark plugs have tiny Belden cables. Its livery is correspondingly as accurate: there are a number of variations available-I got Clark's # 5 car as it originally appeared at Zandvoort in June of '67. (Also available: a wonderful 1:18 recreation of Pete Brock's Daytona Coupe for the Shelby Cobra. Same year, same number-Gurney's car-same price.) If you love "GPL"....

"The Racing Driver," by Denis Jenkinson (Bentley, 1959). "Jenks" was the world's first gonzo journalist (before Wolfe, Thompson, and Charlie Fox), having ridden sidecar with World Champion Eric Oliver, and navigated for Stirling Moss (they won the '55 Mille Miglia in a Mercedes 300SLR), and this is the book where he first posited the notion of "tenths." That is, ordinary mortals think they have the tiger by the tail, when in fact they're motoring along at two or three "tenths" of human driving potential. A world-class driver can win races without ever exceeding seven or eight tenths, but are capable of giving nine or ten tenths when the occasion demands. Also here, some weird theories about why-and how-drivers like Moss and Fangio are as good as they are. Dated but fascinating. Available from Classic Motorbooks.

Skip Barber Racing School (www.skipbarber.com; 800-221-1131). If you think you might want to try real-world auto racing, this is where the guys at Papyrus learned how. They conduct several Race Driving 101 (and 102 and 201 and 202, etc.) schools around the country at tracks like Watkins Glen, Lime Rock, Sebring, Mid-Ohio, Sears Point, and Laguna Seca, in vehicles ranging from Plymouth Neons to 240-horsepower single-seaters.

"The Technique of Motor Racing," by Piero Taruffi (Bentley, 1969). Long out of print, this classic work is a perfect companion-piece to "Grand Prix Legends." Unlike more recent how-to-race books, this one dates from the same era as what's being simulated, and Taruffi (aka "The Silver Fox;" he won the last Mille Miglia in l956) describes the very techniques which were employed by Hill, Clark, et alia, ten years later. Nicely illustrated with period photos, track maps, and technical-looking line drawings. If you can find it, this book is considerably more applicable (and less turgid) than the highly-touted "Ayrton Senna's Principles of Race Driving," which reads like a computer translation of another computer's prose.

ThunderSeat (www.thunderseat.net; 800-884-8633). This ingenious gizmo combines a padded fiberglass racing seat with a base-mounted subwoofer for a real kick in the pants. Highly recommended, but expensive. You could probably build one yourself.

Top Ten Reasons Racing Is (Almost) Better Than Sex (thanks to Dave Mansell's "Skunk Racing" page: www.fan.net.au)

10. It's socially acceptable to do it while others watch

9. Bigger cars don't necessarily get more attention

8. The phone won't ring while you're in the middle of the race

7. You get to use your rubber more than once

6. You don't have to sit through dinner and a movie beforehand

5. You and the car always finish at the same time

4. You always know exactly where to put your hands

3. You drive as hard as you can, right from the git-go

2. The quicker you finish, the better you are

1. You can do it more than once in one afternoon

Vintage Motorsport (www.revupsci@aol.com; 800-626-9937). A self-consciously upscale bimonthly magazine, full of puff pieces and drop-dead-gorgeous photography, beautifully printed, of interest to anybody even remotely interested in the era simulated in "Grand Prix Legends." VM is the official publication of HSR (Historic Sportscar [sic] Racing; 888-477-5999), the outfit that sanctions events like the recent Grand Prix "reunion" at Watkins Glen. Thirty-five bucks a year.

Watkins Glen. If you want to see what the Glen looks like today, check out Papyrus' premier simulation, "NASCAR Racing 2" (coming soon: "NASCAR Racing 3"), which features the layout the Winston Cup cars run on these days. Much of the circuit (from the Ninety to the Chute) looks the way it does in "GPL." A word of
caution: "modern" (I use the term loosely) stock cars don't handle anything like vintage GP cars, so be prepared for some retraining. Or you could visit the track in person (607-535-2481). Worth a detour, as they say.

Enjoy!

CUSTOMER SERVICES

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Lines open 24 hrs, 365 days a year, using our automated technical support attendant. This system includes answers to all commonly posed questions and problems with our new and major titles. It is set up in a friendly and easy to use menu system that you navigate through using a touch tone telephone. If the answer to your question is not in our automated system, then you will be transferred to a technician between the hours of **9am and 5.00pm Monday to Friday.**

Here are some key-presses that will allow you to navigate through our automated attendant. Note that these are the standard letter assignments that are given to UK telephones so if your phone has letters on the keypad, please use them instead:

2: A, B, C	3: D, E, F	4: G, H, I	5: J, K, L	6: M, N, O	7: P, R, S	8: T, U, V	9: W, X, Y	0: Q, Z

Before you call our technical support lines, please check that you have read the Readme file included on the game disk #1. You may well find a very quick answer to the problem that you are facing as these files contain answers to most common problems. If the answer is not here, make sure you have precise details of any error message that you receive, and details regarding the specifications of your computer before you call us, as this will help us in giving you a faster and more efficient service.

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