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DECEMBER 2008 roadandtrack.com

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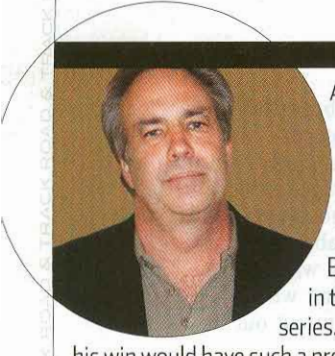


At Sears Point in 1977, David Hobbs drove his turbo-charged, Citicorp-sponsored BMW 320i—"The Flying Brick"—to victory in the IMSA Camel GT series. Little did he know his win would have such a profound effect on **Steve Dinan,** who relished the small-displacement German car beating up on its rivals. Dinan, who worked at a BMW repair shop at the time, regarded the production cars from Munich to be well engineered but lacking power. Suitably inspired, this largely self-taught mechanical engineering prodigy founded Dinan Cars in 1979, and went on to become one of the most highly respected tuners in the industry. Thirty years later, the youthful 55-year-old, whose rapid-fire delivery struggles to keep pace with a brain on overdrive, continues his perfectionist ways with the Dinan S3 M6 (page 87). Steve lives near his shop in Morgan Hill, California, with his wife, Jan.

For this month's technical feature, we decided to explore the wonders of racing in a virtual world. **Dave Kaemmer,** the president/CEO and co-founder of iRacing.com, is no newcomer to racing simulation. As cofounder of the Papyrus Design Group back in 1987, the company responsible for developing many distinguished simulations such as *NASCAR Racing: 2003 Season* and *Grand Prix Legends,* Kaemmer possesses a wealth of knowledge and over 20 years of experience in this industry. As brilliant a pioneer as he is, a lot of Kaemmer's ingenuity didn't simply materialize from theory as he also shares a passion for the real thing. Multiple seasons in the Skip Barber open-wheel series with over 95 starts and 18 or so victories are bound to teach you a thing or two about racing.

RACING in the Virtual World

Could fantasy be reality's new best friend?

BY JONATHAN ELFALAN

THERE'S A CLUB RACE THIS WEEKEND, it's Thursday afternoon and I have yet to phone a friend for permission, once again, to borrow his trailer and save a trip to U-Haul. It's crazy, when you actually think about it, that this hobby is worth the time and money spent driving three hours to stay in a roach motel, arriving at sunrise the next morning to hang around a loud, fume-filled and sun-baked paddock for 12 hours before turning around to head home. Fact is, a weekend like this involves a lot of preparation and forethought for success. A decision made in haste can cause the fun to crumble as quickly as it came about.

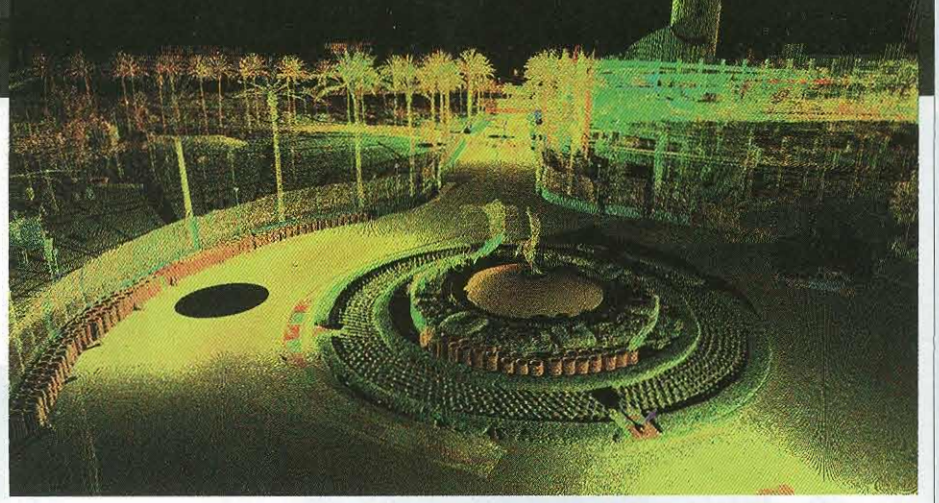
Virtual racing wasn't created to displace the hands-on adrenaline fix enthusiasts find at all-too-frequently far-away tracks. But it does provide an alternative, and makes sense given today's evolving technology. Heck, it's far cheaper, more accessible and even can be done in the comfort of your own home!

In recent months, I visited the headquarters of iRacing.com—one of the foremost racing simulation companies—to dissect the formula for engineering a top-notch simulator. What I learned blew my world to "bits."

TRACK MAPPING

One of the innovative aspects of iRacing's simulator is the accuracy of their tracks. They're built with painstaking detail. Ever try sculpting a three-dimensional object from a photograph? It's difficult to do when you are missing vital information. That's why iRacing physically scans every track they replicate using an advanced, not to mention expensive, Leica laser scanner usually reserved for detailed surveying tasks.

Calling this process painstaking is an understatement. I sat down with one of the scanner technicians as he went over the



routine of operating this $120,000 piece of equipment, which sits atop a custom-built, 12-ft.-tall tripod dolly.

Depending on the level of detail of the track and its surroundings, a scanner technician may be required to take more scans than the average of one every 350 ft. Before initiating each scan, which takes a full hour to complete, the laser scanner is rolled out to its designated location and leveled. The scanner then rotates 360 degrees to produce a virtual sculpture, or point cloud, of everything in its line of sight. Eight reflective spheres, which serve as markers in space, are placed at key points on the track for each scan, so software engineers can accurately stitch everything together in post-processing.

So now you've got a whole bunch of dots in space. Because you can't simply drive on dots, iRacing created proprietary software to transform all these data into a useful surface, replete with bumps that you can actually feel through a force-feedback steering wheel. The complexity of this process isn't just for show; it's for surface accuracy within millimeters. And it goes further than this.

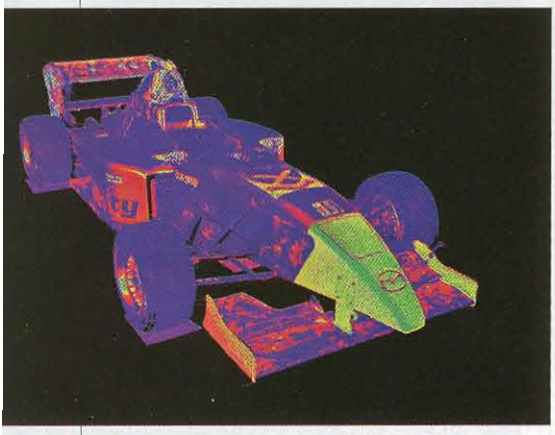
Because the scanners also pinpoint details of the peripherals around the track, iRacing uses these data, along with thousands of digital photos, to recreate every visual marker in your line of sight. This may not sound that important, but if you've ever been on a race track, you know that everything from tree shrubs to pavement blemishes can be used as reference points to learn a track and perfect your driving line.

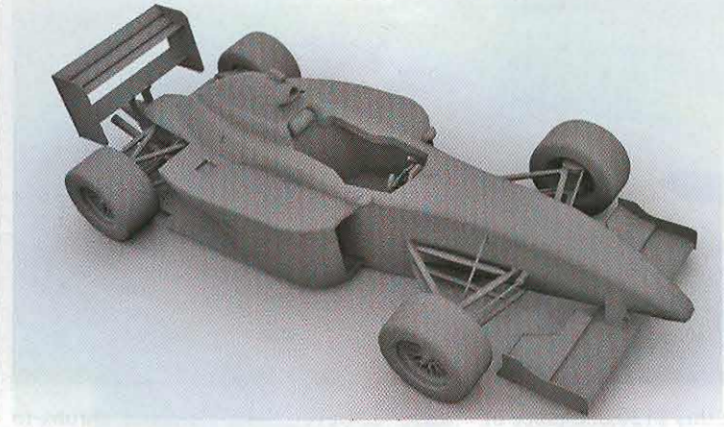
I spent a good portion of the day lapping iRacing's virtual Mazda Raceway Laguna Seca—a track I was already pretty familiar with—and could clearly identify key points on track from previous Skip Barber schools, including the hypercritical tree I usually aim for when entering the Turn 8 Corkscrew. It really was as if I was driving *the* track, not just some close approximation of it. Could these guys be on to something?

CAR MODELING

So as an iRacing newbie, I began my orientation sessions in what is called the "Rookie Pontiac Solstice," with the aim of learning to crawl before I walk. Each of the eight vehicles currently modeled in the simulator has handling characteristics that are discernibly unique because everything from the tires to the suspension geometry and even aerodynamics has been taken into

» Laser scanning is a walk in the park granted you know what you are doing and don't mind repeating it 50 times over. Here, the iRacing team takes scans of the fountain area on the streets of the Long Beach Grand Prix (the point cloud is shown above). Any non-reflective surfaces are hand dusted with white powder for the scannner to pick up.





account. Each vehicle, save for the Rookie Solstice, also features incredibly liberal parameters of adjustability, concurrent with what is allowed for that car in real life (i.e., caster, camber, toe, gear ratios and even wing angle for the open wheelers).

Laser scanning, once again, plays a role in recording the overall physical shape and size of a vehicle's shell. Adding further to the precision, parts such as suspension arms are removed to find their weights, dimensions and range of motion. All of the data are then assembled back into a highly complex physics model with a definition all to itself.

If wind-tunnel data are available, as with the open-wheel Formula Mazda, they're integrated into the aerodynamics model for the car. If there are no data, close approximations are made. With cars such as the Solstice, aerodynamic models are aided by a good understanding of computational fluid dynamics (CFD).

Finally, extensive research goes into the creation of the tire model for each vehicle. Dave Kaemmer, iRacing's CEO, made multiple trips to the Calspan Tire Research Facility to gather data relevant to nearly every possible race-track scenario experienced—we overheard some 45-degree camber angle testing was even included in the realm of possibility.

As I left the virtual Lime Rock pits for the first time, I failed to remember that the simulation engineers paid attention to such details as tire temperature, and came embarrassingly close to a cold-lap spin going

"What separates iRacing's simulator from an elaborate video game is what separates the game of golf from miniature golf."

» Each vehicle is modeled to its exact specifications, meaning it's as easy (or hard) to drive in the sim as it is in real life. Paint schemes for the cars are customizable, just as they are for your virtual helmet and driving suit.

into the first right-hander. I guess they call it a Rookie Solstice for a reason. Needless to say, after some valuable coaching tips by my iRacing driving instructors, I came away with a handful of clean laps, a brand-new track committed to memory for future use and was finally ready for some wheel-to-wheel action!

REAL RACING SANS DANGER

What separates iRacing's simulator from what many may consider an elaborate video game is what separates the game of golf from miniature golf. If you understand how to pilot a car effectively at speed in the physical world, the same laws apply in the sim. Make contact with a solid object, and your car will be damaged to the same extent it would be in real life, minus the risk of death or injury following a spectacular crash.

And yes, I know it's easier (and less expensive) to start a new sim than to repair your actual car, but like any real race weekend, iRacing requires you to register and arrive at a specific time for an event. For each sanctioned race, there are practice and qualifying sessions that will determine your place on the start grid. Penalties are distributed accordingly with reference to the Sporting Code (by-laws), with the opportunity to appeal an unfavorable incident. And, lastly, you race under your real name—there

» Many hours are spent at the Calspan Tire Research Facility collecting vital data for an ever-evolving physics model. Vehicle Dynamics Engineer, Ian Berwick, and CEO, Dave Kaemmer, take measurements off a hot tire.

»Patience is a virtue, and also the key to learning to drive a sim effectively. Approach it like you would the real thing, and you are sure to pick it up as your mind begins to create physical sensations of moving at speed. iRacing's staff includes many real-life racers and driving instructors like Ian Berwick who coaches the author on an orientation lap of Road America.

are no pseudonyms to hide behind.

Intelligently, the motorsport license architecture in iRacing is designed around your ability to drive safely near others and stay on track, which replaces the element of danger with the fear of never advancing up the ranks. It's still important to be fast in order to gain points, but even more so to be clean and consistent.

So here I am, finally staging up for my first virtual race, feeling unsettled by an unexpected surge of adrenaline. All the valuable Jedi teachings and practice drills flashing through my mind soon short-circuit as I false start the green and get a drive-through penalty on the very first lap. Rats. Dead last is never something to be happy about, but at least this time I won't be spending a long drive home thinking about it.

Simulators for the Rich and Famous

iRacing isn't the only driving simulator in existence, but it sure is one of the most economical ($299 for the recommended Logitech G25 wheel plus $13/month membership). Consider the one I saw in the July 2008 issue of *Racecar Engineering:* Created by Wirth Research, it costs a little over $11,000 a day to *rent!* The simulator, suspended over a triangular platform and supported by six Moog electric rams providing the sensation of motion, has software that incorporates a number of different modules operating at up to 1000 Hz. Six 64-bit processors are required to handle the influx of data. The Wirth simulator (photo below) can operate autonomously (it self-drives a perfect lap given specific settings) or with a driver in the loop. An extremely powerful tool for driver and racecar development, the Wirth simulator has been used by teams competing in the ALMS and Formula 1.—*JE*