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I-DEAS Races to Victory

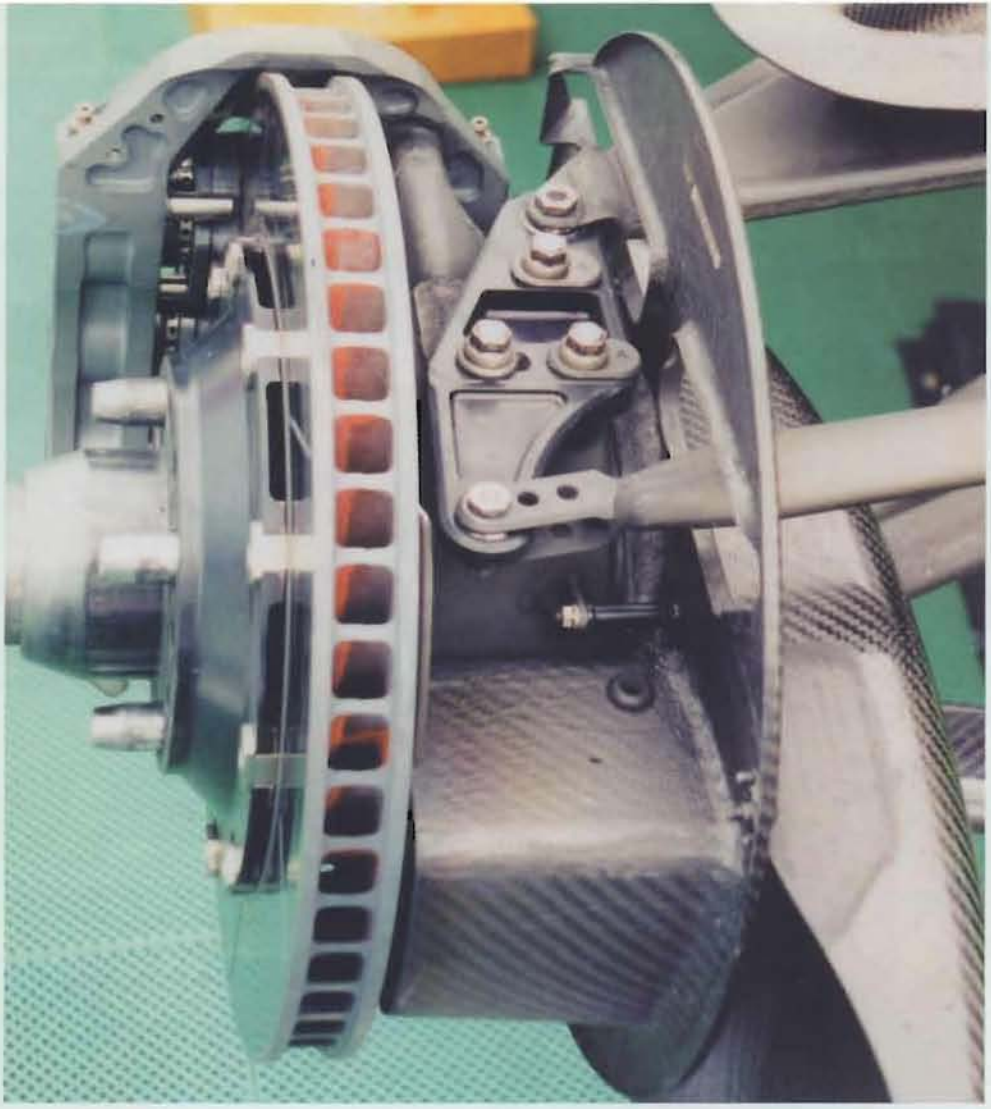
▶ Team KOOL Green (TKG) racecars of Paul Tracy and Dario Franchitti under heavy breaking at the end of the main straight during the early stages of the Freightliner/G.I. Joe's 200 at Portland International Raceway.
(Image courtesy David Cohn)

I-DEAS Software helps power racecars from Team KOOL Green to the checkered flag.

David Cohn

Success in auto racing—particularly the exciting, high-stakes, open-wheel racing of the CART (Championship Auto Racing Teams) FedEx Champ Car Series—depends on much more than just a fast car and a talented driver. Every part of the race car must operate flawlessly. It's a combination of lots of little things that helps win races. Preparation and planning is everything. Since February 1997, Team KOOL Green (TKG) has used I-DEAS software running on Hewlett-Packard NT workstations to develop that winning edge. The Indianapolis-based race team uses I-DEAS for the design and optimization of racecar components and manufactures most of them at its 44,000-square-foot Indianapolis facility.

Design and preparation have paid off, helping Dario Franchitti and Paul Tracy, both in their



◀ After designing a part in I-DEAS, Team KOOL Green (TKG) machinists manufacture the part from billet alloy steel and install it on the racecar. *(Image courtesy David Cohn)*

fourth season driving the distinctive green and white Honda-powered Reynard Champ cars, to a total of 40 podium finishes. (The top three finishers in a race stand atop a podium at the end of the race.) Tracy has won five races and was third in the overall standings in 1999. Franchitti won three races in both 1998 and 1999; he finished those seasons ranked third and second overall, respectively. After twelve races this year, he's currently third in the point standings with nine races remaining. And for this season, team owner Barry Green has also partnered with Motorola to prepare a car for Michael Andretti, the winningest active CART driver with 41 career wins. Andretti, son of racing legend Mario Andretti, is currently fourth in the point standings.

STRIP IT DOWN AND TWEAK IT

None of the 18 CART race teams actually design and build their cars, but rather purchase each chassis from Lola or Reynard, and a season's worth of engines from Ford-Cosworth, Honda, or Toyota. When the Reynard 011 shows up at the team's shop, it's theoretically ready to race. But for TKG, that's just the beginning.

The car, constructed of honeycomb composite carbon fiber, measures 199 inches long, 36 inches high, and 78.5 inches wide, with a 124-inch wheelbase. It weighs only 1,550 pounds (compared to more than 3,000 pounds for a typical passenger car), carries 35 gallons of fuel, gets 1.85 miles per gallon, and costs around $500,000 (not including the engine). On a race weekend, TKG brings two cars to the track for each driver—a primary and a backup—for a total of six cars. And of course it maintains a couple of spare cars back in Indianapolis for mid-season replacement, just in case.

And then there are the engines, which cost the team well over $1 million for the season. There are around a dozen methanol-burning turbocharged V-8 Honda HR-1 series engines in rotation at TKG. Each engine is used for an average of 450 miles before it is sent back to Honda to be rebuilt (at a cost of around $50,000). With most races averaging 200 miles, the team uses the engine from the previous race for qualifying at the next race, and then replaces it with a fresh engine for race day.

Other than removing and replacing them, TKG does very little to the engines. The chassis is another story, however. "We strip it all down and do our own tweaks to get it ready," says Scott Graves, TKG director of engineering and an assistant race engineer for the #27 car of Dario Franchitti. The team redesigns many of the body components, looking to improve the aerodynamics of the race car. Using I-DEAS, Graves and his team model body-part surfaces and then scale them down to 40% of their actual size to create mod-

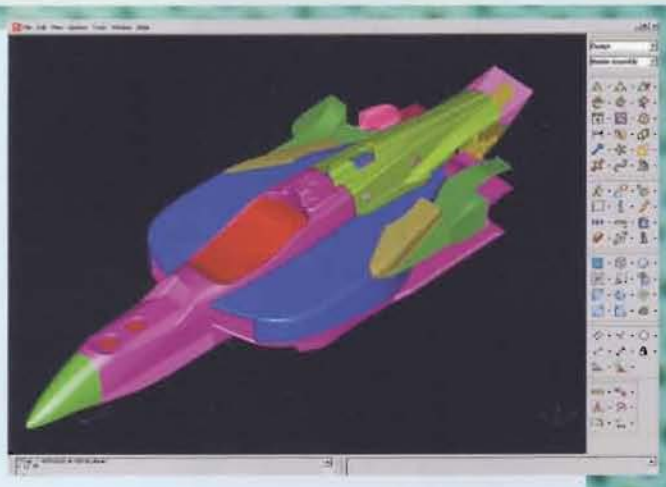


Figure 1: TKG engineers use I-DEAS to create surface models of bodywork components. The aerodynamics of the car is constantly being improved through wind tunnel testing and CFD (computational fluid dynamics) analysis. Each type of track can have its own unique set of body components, which are optimized for maximum aerodynamic performance in that particular configuration. *(Courtesy Team KOOL Green)*

Figure 2: An exploded view of a cross-weight jacker slave cylinder assembly in SDRC's I-DEAS. The weight jacker is hydraulically adjusted by the driver to help maintain consistent handling on oval tracks. The car's handling characteristics change as fuel is burned and track conditions vary through the race. *(Courtesy Team KOOL Green)*

els which are then analyzed in Reynard's wind tunnel (*see Figure 1*), also located in Indianapolis. "We might make ten variations of a single part, go to the wind tunnel, and try each variation," said Graves. "Hopefully, one of them will be an improvement over some previous configuration."

The parts in question could be wing components, side pod parts, winglets, or other aerodynamic devices that are attached to the body to enhance the down force of the car. TKG employs seven full-time engineers who travel to races, plus two R&D engineers who remain back home in Indiana.

In addition to redesigning body parts, TKG engineers also use I-DEAS software to redesign mechanical components including steering and suspension components. "We're quite lucky that Reynard is also heavily into solids and surfaces," noted Graves. "We get a lot of surface data of the existing car from them." Graves takes Reynard's CATIA data, translates it using SDRC's standalone CATIA translator, and then designs custom parts to mate up to the existing surfaces. He also receives Mechanical Desktop files from Alcon, the manufacturer of the cars' brake components.

New parts are designed as 3D solids or surfaces and sent straight to the team's CNC machines, which include a 3-axis milling center and a CNC lathe. "The only reason to generate a paper drawing is so the machinist has something to look at while he's doing the job," say Graves, or if designers send out a job to an independent fabricator.

Graves says that one of the nice things about I-DEAS is that he can take a part originally designed by Reynard, import it into I-DEAS, modify dimensions in the history tree, and send the modified design to the machine shop. The next day, he's got a new variation to try out on the actual car. The engineers may develop half a dozen variations of a suspension rocker, providing different ratios between the springs and the wheels to tune the car's suspension for a particular track.

AN ENGINEERING OFFICE ON WHEELS

While much of the design and testing happens before the season begins, it doesn't stop once the team goes on the road. The team's rolling entourage includes transporters that carry each driver's primary and spare car—one each for Franchitti, Tracy, and Andretti. Once at the track, the transporters become fully fitted workshops, including engineering offices equipped with HP workstations and I-DEAS software. "When we fail a part or have a problem that needs a redesign, or we come up with a new idea for a new type of part, we can't really call back to the shop and say 'Hey, start doing this,'" said Graves. When a question comes up, taking the CAD system on the road also enables engineers to bring up data and interrogate the model.

The cars, pits, transporters, and engineering and fabrication departments are all connected via a computer network. During practice and racing, engineers and crew constantly monitor telemetry radioed from the racecar. Ten or twenty years ago, the drivers may have been integrally involved in the preparation of the cars. Today they generally just show up and drive. "They drive the car and tell us what it takes to make it go quicker," said Graves. "We adjust things based on their feedback and look at the data that we log on the car." (*See Figure 2.*)

Dario Franchitti's #27 Reynard racecar is pursued by Oriol Servia during the Freightliner/G.I. Joe's 200. *(Image courtesy David Cohn)*

The hard work and preparation pay off. Team Owner Barry Green has logged two championship titles, two Indy 500 victories, and 37 CART wins. Paul Tracy's career earnings total more than $8 million. Dario Franchitti, who has only been driving since 1997, had already won more than $3.6 million before the start of this season. Franchitti managed a sixth place finish on the rain-soaked Portland, Oregon, track. The following week, on the temporary Cleveland, Ohio, road course, Dario Franchitti took the checkered flag, his seventh career CART Champ Car victory and the first of the season for Team KOOL Green. Two weeks later, it was Michael Andretti's turn, winning for a record seventh time through the streets of Toronto. And in both Cleveland and Toronto, the winning Reynard had the SDRC logo emblazoned on its winglets, which were designed using SDRC's I-DEAS software.

PRODUCT INFORMATION

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Contributing editor **David Cohn** *became a race fan at a very young age, when he met such famed drivers as Mark Donohue, Dan Gurney, and Mario Andretti. When not photographing races, he's a computer consultant and technical writer based in Bellingham, WA. He's also the Editor-in-Chief of* ***Engineering Automation Report****, and the author of a dozen books on AutoCAD including* ***AutoCAD 2000: The Complete Reference****, from Osborne/McGraw-Hill. You can contact him via e-mail at dcohn@home.com.*