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EXCLUSIVE: Swift's IndyCar plan

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The phrase, “It looks like it was designed by a committee!” is seldom a comment of kindness. Applied to everything from a duckbill platypus to the Ford Edsel to numerous examples of bad architecture, it implies that the whole is far less than the sum of its parts.

While every modern racecar is essentially designed by a committee – aerodynamicists, engineers, stylists, engine manufacturers and tire manufacturers all work together to try to achieve speed, safety, cost-effectiveness and beauty in one package – Swift Engineering has taken it a step further in designing what it hopes is the car that will fill the grid when the IZOD IndyCar Series opens its 2012 season.

And although racecar development is usually done in strict secrecy, as the Indy Racing League goes through the process of deciding what the replacement for the aging Dallara chassis should be, the competing manufacturers – Swift, Dallara Automobili, Lola Cars, DeltaWing Racing Cars and BAT Engineering – have all shared their designs with the public. In some cases they have offered more than one design, or allowed the fans to follow along with the process.

That's where the “committee” comes into play. Swift's design team says they have tried to involve every stakeholder – including the IRL, Honda and Firestone, but also the teams, sponsors and the fans, who ultimately decide whether the on-track product is worth their attention – in the process as it evolves the car from its initial design.

“Typically we do these design iterations in house,” says Swift Senior Engineer Neil Roberts. “But for this program we decided to involve everyone we possibly could and make this more of a team effort. We

certainly have our own ideas of what a racecar should look like, and so does everybody else. We're willing to listen to input from all sources."

Swift has given RACER.com an exclusive look inside the process of evolution of what it hopes will be the next Indy car. And the reality is that the different manufacturers are likely competing against each other *now*, rather than on the track later. The direction the design team is taking is leading them to the production of a spec chassis – not necessarily because they want it that way, but because they say the only way to achieve the cost containment the league wants is with a one-make series.

Swift Chief Scientist Mark Page, like many open-wheel fans, fondly remembers the glory days of CART when Swift, Penske, Lola, Reynard and Eagle all competed against each other with Toyota, Honda, Mercedes-Benz and Ford engines on Firestone and Goodyear tires. That competitive spirit goes back to the San Clemente, Calif., firm's beginnings, when it produced a fairly radical Formula Ford chassis for 1983 that soon dominated the market and is still competitive nearly 30 years later. The company went on to produce a variety of winning club and entry-level pro chassis for a variety of categories before building a Champ Car that won on its first outing at Homestead in 1997, with Michael Andretti at the wheel (below).

Both the company and the racing world have changed significantly in the past 13 years. While Swift is still obviously heavily involved in motorsports, having been the sole supplier of the hopefully-on-temporary-hiatus professional Formula Atlantic series chassis since 1998 and now the chassis supplier for the Formula Nippon Series in Japan, much of its business now involves aerospace, including producing unmanned aerial vehicles and making composite pieces for other manufacturers. The wind tunnel next door is also kept busy, not only testing automotive and aerospace designs, but also designs of buildings, to make sure they can withstand high winds.

Motorsports, especially with the recent economic times, have changed as well. CART/Champ Car is no more and the IZOD IndyCar Series is suffering like every other entertainment venue in a tough economy. The budgets are no longer there for most teams to run in a competitive chassis program. According to Page, it's simply not possible to have that and meet the cost goal of $370,000 for a complete chassis kit.

"The number they're talking about needing today is at least threefold less than a competitive chassis program," says Page. "If you have to win to keep getting fed, you have to invest hugely more than you would on a spec car. And it kills us, because we want that. But you can't have it all. Everybody's hope is that when the economics for open-wheel racing return, everybody wants to aim that way. Nobody wants to see an eternal single chassis."

As critical as cost, many of the innovations that Swift is looking to incorporate are simply not possible if they have to build a car to compete with others. One area they're looking at is to tweak the aerodynamics

to make passing easier. No manufacturer is going to make its car easier to pass by a competing chassis if they can help it.

“The car that you build for a spec series is very different than what you would build for an open competition series,” says Roberts.

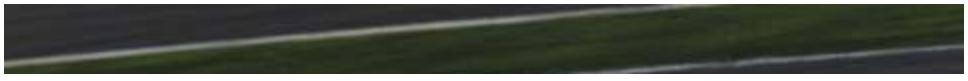
Adds Casper van der Schoot, Swift's motorsports director: “When a spec formula is adopted, what it does is give you freedom in certain areas that you would not otherwise have. So you can be a little more creative with the way the car looks and the way it's perceived by the viewers, which otherwise you couldn't for performance reasons.”

It allows appearance to be part of the equation when designing a racecar. While great function often begets beautiful form, sometimes it's a trade-off. And in attracting an audience, as Roberts notes: “Certainly the importance of appearance is enormous. That's what sells a program and keeps it sold. Not just in automotive – we've seen the same thing in our aircraft programs and some of our aerospace work. If something looks proper, functional and attractive, it tends to gain some momentum.

“One thing we try to integrate into every design we do is what we call aero styling. The aerodynamicist and the body surface designers sit down and design the car together at the same screen. Quite often you end up with racecars that aren't very attractive. But optimum performance and beauty can go together. Consider the populations of birds and fish…there are some ugly fish, but they're all slow.”So the challenge that lay before the design team is a car that makes the fans, series, teams, sponsors and drivers happy while creating a machine that erases the “Crapwagon” term sometimes applied derogatorily to the current crop of cars, from memory. They believed they had the right architecture to build from.

“We used the [Formula Nippon] car (shown below -*Ed.*) as a starting point,” explains Chief Designer Chris Norris. “It's a car of similar horsepower, weight and size to what the IRL is proposing in the verbal brief that we've been given to this point. The early designs – 22, 32 and 33 – were based on that architecture. We then received some more input from the IRL that sent us back to the CAD screens and we revised some things.

“We've spoken to Dr. Terry Trammell and taken some input from him in regard to increased driver protection. One of the concerns they've got at the moment is with the driver sitting in the bottom of the car, there is no compliance in the load path between the car hitting the ground and the driver's spine. In accommodating the 3in. foam pad, that's required us to move some things around.”



The first three cars Swift

released to the public were not different concepts, but evolutions of the initial, No. 23, concept. With a list of stakeholders in hand, and the idea to improve the product for every one of the stakeholders in mind, the team went to work.

“One of the things we dreamed up as we looked at this, when we looked back at the history of these cars, that we thought would capture Indy, were some of the 1960s race cars that were streamlined aerodynamic beauties in the front and exposed mechanicals in the back. The gleaming chrome…this thing was a machine, no ifs, ands or buts about it. So we explored the idea of exposing the engine to capture that historical aspect and also give a little love to the engine manufacturers,” explains Page.

After showing the IRL the initial concept, the team got feedback that emphasized a couple of points. One was safety, specifically something to prevent interlocking of wheels that often will send a car airborne. Another was greener racing. Third was to make sure that there was a lot of room for signage, given the sponsor-driven nature of the sport.

Drag reduction – for greener racing – led to the tire fairings and the rear-wing endplates blended into the bodywork of the No. 32 concept. Experiments with that concept led to No. 33.

“We took that [32] car, which had rather full bodywork, and I took a shot at vacu-forming the car down to be a little more minimal, and just doing something different with the front end treatment. This was just one little side step to explore. It was better performing in terms of aerodynamics, but it was going in the wrong direction for signage.”

There's signage again. Everyone in racing has realized that the more space for signage, the more sponsor dollars that can be acquired. That fact, along with some team engineers not being too keen on having the car's core bits exposed, led to the abandonment of the open bodywork over the engine. Fan feedback – much of it acquired through Swift engineer Rachel Nichols' Facebook and Twitter operations – indicated that people liked the exposed engine, but that it wasn't critical.

The exposed engine remained for the No. 50 concept, though. That concept was the point that the Formula Nippon car no longer remained a viable option, due to the increased size of the monocoque both for driver protection and to accommodate Justin Wilson-sized drivers. But with a taller tub came more drag, so they narrowed the car, bringing the track down by about 2in.

“The No. 66 car is when we started consolidating those ideas, but really getting down to saying, ‘Let's evolve this car and really start working the aero hard,'” says Page, while noting that teams weren't crazy about the exposed engine and the lack of bodywork space for sponsor logos. “Perhaps that was one of the biggest surprises to us, that even some of the engineers and drivers were adamant about how important it is to service the sponsor. We got that message, faired over the engine again, and added a center-line fin to add even more signage. We started looking at even more enhanced mushroom busting – you see a new rear wing that we have here for better raceability.”

Mushroom busting? While it sounds like another euphemism for an off-track excursion such as agricultural racing or mowing the grass, it's really all about wake management. It's one of those things that the design team says is possible with a spec car, but the last thing a manufacturer wants to build into a car that has to compete with other chassis. The term comes from the shape of a racecar's wake, which tends to rise up and swirl around the side. In cross-section, it looks like a mushroom. On road courses, it's one of the things that make it so hard to pass, because when one car follows another closely, it loses a bunch of downforce thanks to the turbulent air from the car in front. Managing that wake, or busting the mushroom, became a key goal. While they had had some success with it on the Nippon car, they

were aiming to take it to a whole new level with this one.

“We found a way that we could take the wake a car punches in the air and really squeeze it out of the way so that the trailing car doesn't have any performance deficit, especially when overtaking on a road course,” says aerodynamicist Andy Lou. “All the way through the 66 car, this was just kind of a concept, and we really had no way of saying it worked.” If the computational fluid dynamics are correct, the wake will rise up and over the trailing car, with a car one length behind have only minimal dirty air on the front wing, and none on the rear. The front wing is being designed to better cope with what wake is left.”

Of course, the opposite effect is desired on ovals. That was proven by the Hanford device used on superspeedways in CART's later years. Its purpose was to put as big a hole in the air as possible, and keep it open for as long as possible. Designed by then-Swift engineer Mark Hanford, it produced some of the closest and pass-friendly racing ever seen.

“To achieve that, we're doing the opposite of mushroom busting; we're leaving the wake alone,” says Page. “That's challenging as well, because cars naturally move the wake around. They punch a hole and the vortices they make cause it to deform. We want it to punch a hole, but we don't want it to move. We're working on ways to make the wake stay in place so you have the longest possible run-up on the lead car.”

The design team believes the difference can be achieved by removing some flaps and swapping wing end-plates front and rear. It's part of making the conversion from road course to oval much simpler and cost-effective. Now, using a car designed strictly for ovals, converting is enough of a chore that the IndyCar Series rearranged its schedule this year to better group road/street courses and ovals together. As Roberts notes, the intention for this car is for there to be essentially a single configuration with a really big adjustment range.

The team is now working on the latest evolution, which will more fully incorporate the mushroom-busting idea. Other developments include a greater incline on the rear wing, fences and blade behind the front tires, along with more gently sloping sides to the sidepods. That's all to make it easier to see the sponsor logos, and keep them in the sunlight longer.

No one knows which way those making the final recommendations about the next Indy car chassis – dubbed the ICONIC (Innovative, Competitive, Open-wheel, New, Industry-relevant, Cost-effective) board and including Indy 500 winner Gil de Ferran, the IRL's Brian Barnhart, former Jaguar F1 team principal Tony Purnell, Texas Motor Speedway President Eddie Gossage and Tony Cotman, among others – will go. They could open it up to all comers, choose a couple of manufacturers or opt for a one-make series. Swift may long for open competition, but its team is designing a car for a spec series. If that is the direction the league decides to go in, and Swift is awarded the contract, the next IndyCar Series car will have, indeed, been designed by committee.