The heck with spec

Paint is about the only distinguishing feature of modern Indy race cars. That wasn't always the case.

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Senior Editor

Vehicles in the IndyCar Series are a study in strict conformity to ever-more stringent specifications. Chassis this year come from one of two builders: Dallara and Panoz. Honda 3.5-liter V8 engines power the whole field. No doubt, the approach levels the playing field, lowers costs, and makes for spectacularly close finishes.

But the Indy-car spec was not always so tightly defined. Race teams and regulators back in the day took greater engineering risks that sometimes didn't pan out, but in others, far exceeded expectations and forever altered the sport. Advancements that gave pioneering teams unfair — albeit brief — competitive advantages as well as the inevitable crashes prompted further changes.

With that in mind, consider some notable hits and misses of the Greatest Spectacle in Racing, as well as what's new this year.

2007 — Ethanol supplants methanol

Following a successful transition to a 90/10 (methanol/ethanol) blend in 2006, Indy cars this year switch to 100% ethanol for racing fuel, the same stuff blended with gasoline and sold at the pump.

1972 — Wings help speeds soar

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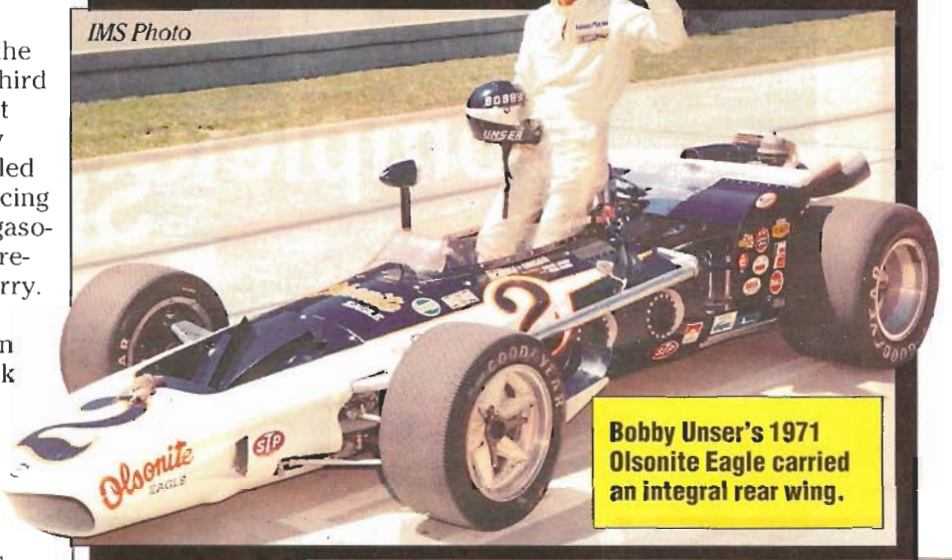

Bobby Unser's 1971 Olsonite Eagle carried an integral rear wing.

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Peter Revson's 1972 McClaren shows how rear wings dramatically grew in size from the previous year.

Bolt-on rear wings debuted in 1972 and are one of the most significant and enduring technological breakthroughs in Indy-car design. Rules allowed integral wings a year earlier, and some cars had them. But the massive bolt-on variety could be separate from the body work and extend nearly 3 ft off the ground. The effect was dramatic. Bobby Unser in his Olsonite Eagle qualified at 195.940 mph, nearly 17 mph faster than Peter Revson's 1971 record. The speed jump remains the largest in Indy 500 history.

The move, designed to spur the U.S. ethanol industry, is the third major change in fuel. The first came in 1965 following a fiery crash the year before that killed two drivers and prompted racing officials to change fuel from gasoline to methanol and later to reduce the amount of it cars carry.

Why methanol? For one, it burns cleaner than gasoline in open air, eliminating the black smoke that worsened the 1964 accident. And water can extinguish a methanol fire while gasoline fires need chemical extinguishers. Besides improved safety, methanol also happens to be a great fuel for racing engines.

Methanol has a higher octane rating than gasoline so engines can run higher compression ratios without damaging detonation. Efficient combustion of methanol requires air:fuel mixtures on the order of 5:1 versus about 13:1 for gasoline. Engines, therefore, can burn richer mixtures of methanol and make more power. However, they need larger intake and exhaust ports to handle the additional fuel load. A greater fuel volume also boosts evaporative cooling in the intake tract and helps lower engine operating temperatures. Methanol burns slightly cooler (about 100 to 150°F) than gasoline, further lowering operating temperatures.

Comparing methanol and ethanol performance-wise is mostly a wash. Ethanol has about 25% higher energy content than ethanol, but methanol's higher latent heat of vaporization boosts intake cooling and charge density. Indy cars get slightly better mileage running ethanol, so officials cut fuel capacity to 22 versus 30 gallons last year.

All teams run an ethanol-fired Honda 3.5-liter V8 engine, up from 3.0 liter in 2006. Honda says the displacement bump should help engines go longer between rebuilds and give more midrange torque for races on road courses and short ovals.

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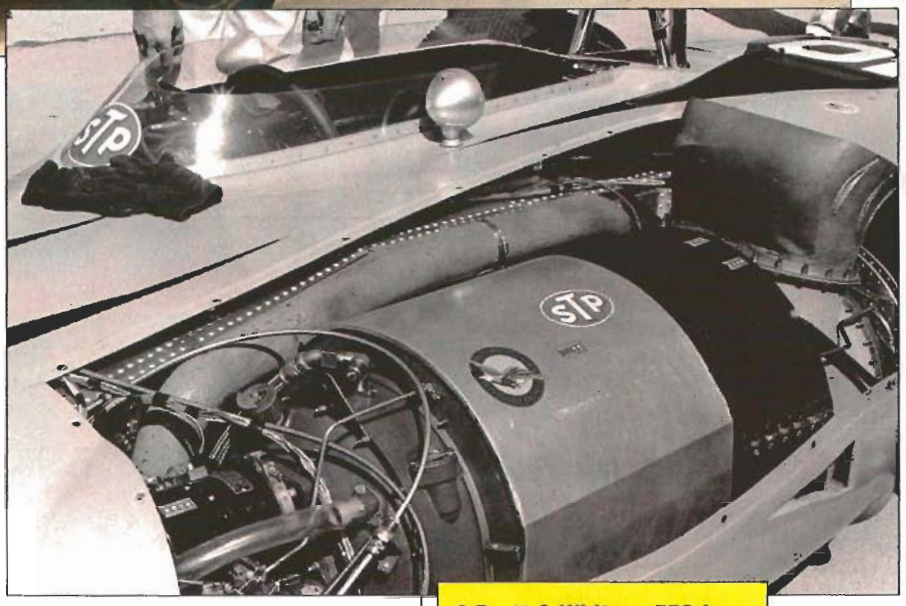

A Pratt & Whitney 550-hp helicopter turbine engine powered the 1967 STP car.

1967 — Turbine time

Probably the most controversial and revolutionary Indy race car in the history of the Indy 500 came in 1967. Andy Granatelli's flame-red STP car sported a 550-hp **Pratt & Whitney** helicopter turbine engine mounted left of the driver (for better handling) mated to four-wheel-drive running gear. Driver Parnelli Jones qualified 6th with the turbine car and on race day led all but 25 of the first 196 laps. But on lap 197 with just 8 miles to go, a $6 bearing in the transmission let go and the car coasted to a stop. A stunned Granatelli looked on as A.J. Foyt took the checkered flag in a Ford-powered Coyote.

Despite the loss, builders of piston racing engines viewed turbines as a threat. The U.S. Auto Club in response cut the size of the turbine's air inlet from 22 to 16 sq in. to reduce power.

Granatelli stayed with the turbine formula for the 1968 season, teaming with Lotus to build a wedge-shaped rear-engine car. Driver Joe Leonard led with the turbine car for several laps, but a late-race accident put the field under caution. The green flag dropped, and with victory just eight laps away, the turbine suffered a flameout when Leonard tried to accelerate. Bobby Unser sped ahead to a win in his Offenhauser Eagle.

The following year, USAC placed even greater restrictions on the turbine engines and banned four-wheel drive after 1969, effectively ending the turbine era.

1965 — Engines take a back seat

Front-engine roadsters powered by four-cylinder, supercharged Offenhauser engines had won every Indy 500 race since 1947. Teams understandably were reluctant to change a winning formula, despite the fact that the roadsters, while fast in a straight line, didn't corner very well.

But in 1961, Grand Prix and Formula One driver Jack Brabham fielded a specially prepared Cooper Formula One car with a 2.7-liter Coventry Climax engine in back. It was underpowered compared with the Offenhauser roadsters, but cornered much better and finished ninth.

Racer Dan Gurney saw the potential of rear-engine cars and convinced British Formula One designer Colin Chapman and Ford to build a Lotus Indy car powered by a 375-hp, production-based pushrod V8 engine. Formula One driver, Jim Clark piloted the car to a second-place finish at the 1963 Indy 500 behind winner Parnelli Jones in a front-engine, Offenhauser-powered roadster.

The following year, Ford developed a more-powerful dual-overhead-cam Indy racing engine. Clark qualified on the pole but the car blew a rear tire during the race and destroyed the rear suspension. Rodger Ward finished second in a rear-engine Ford/Watson chassis, while A.J. Foyt scored what would be the last Indy 500 victory for a front-engine car.

On May 31, 1965, Clark won the 49th Indy 500 in his 475-hp, methanol-fired Lotus-Ford. It was the first Brickyard victory for a Ford-powered car, and the first for a rear-engine chassis. That year, 27 of 33 starting cars had rear engines, 17 of them Fords.

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Jim Clark in his 1965 rear-engine Lotus-Ford.

1954 — Chrysler bests Offenhauser

Chrysler began testing racing versions of its stock-block 331-cu-in. Hemi engine in 1952. The company's A-311 race engine — first used in a car that performed high-speed tire testing for Firestone and Goodyear — incorporated larger ports, roller tappets, and Hillborn fuel injection.

In 1954, Chrysler invited the top-four finishing drivers from that year's Indy 500 to its newly opened Chelsea proving grounds. The drivers took their Offenhauser race cars for a wide-open spin on the highly banked 4.7-mile oval at speeds to 179 mph. Much to their chagrin, the A-311-powered tire-test car went 3 mph faster, showing that the Hemi could compete with the more exotic 270 Offenhauser.

News of the rout spread quickly. Offy owners lobbied the AAA Contest Board to cut displacement of the Hemi engine to 272 cu in. In response, Chrysler shortened the A-311's stroke to meet spec for the 1955 season, but the engine was no longer competitive.

1952 — Diesel smokes the field

Cummins is best known for its commercial diesel truck and marine engines. But in the midst of the Great Depression, the company decided to put a modified marine engine in an Indy race car and generate some much-needed buzz.

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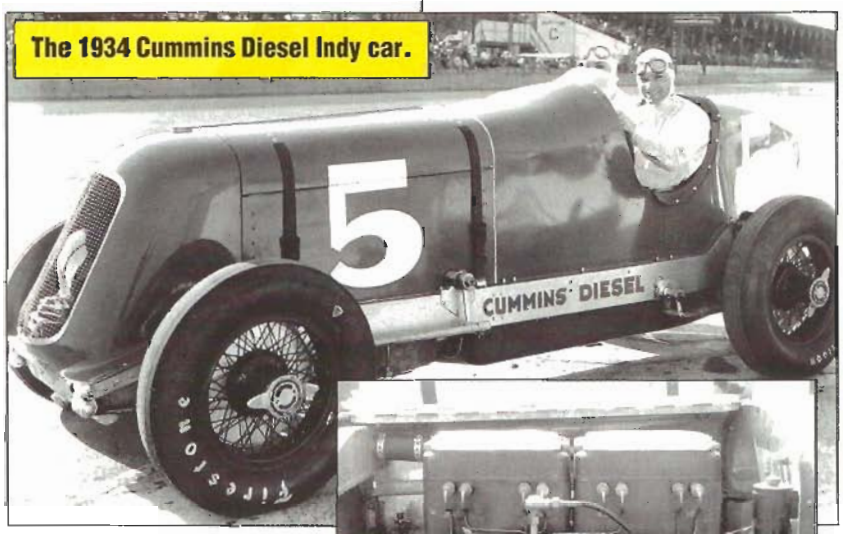
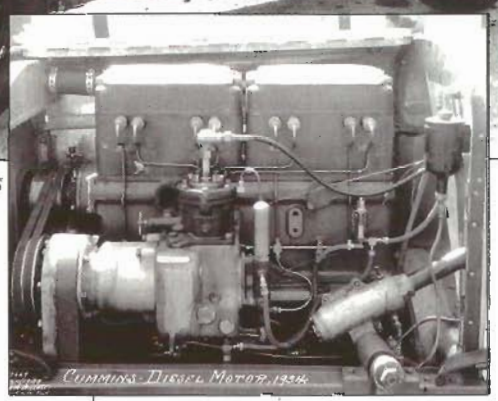
Driver Freddie Agabashian in the 1952 Kurtis-Kraft Cummins Diesel Special.

Indianapolis Speedway owner and AAA Contest Board head Eddie Rickenbacker let Cummins compete in the 1931 Indy 500 as a "special engineering" entry (no prize money) with the proviso that the car average at least 70 mph, or about 40 mph off the pace of state-of-the-art Millers and Duesenbergs. Rickenbacker a year earlier introduced the so-called "Junk Formula" that opened the Indy 500 to stock-block engines up to 366 cu in., offering racers an affordable alternative to the exotic supercharged, straight-eight racing engines of the day.



The 1934 Cummins Diesel Indy car.



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Cummins commissioned Duesenberg to modify a passenger-car chassis for its 85-hp 361-cu-in. four-cylinder marine diesel. The car qualified dead last at 96.871 mph, but finished a respectable 13th of 40 starting cars, averaging 86.107 mph.

Encouraged, Cummins took another shot at the Indy 500 three years later, this time with a pair of Duesenbergs: one powered by a two cycle and the other by a conventional four-cycle diesel engine. Each engine displaced 364 cu in. and was fitted with a Roots supercharger. Both cars qualified, though a transmission problem sidelined the four cycle after 81 laps. The two cycle completed the 200-lap race but seized immediately afterward, thus ending Cummins' brief foray into two-cycle engines.

In 1950, Cummins contracted with California race-car builder Frank Kurtis for a special tubular chassis to accommodate a magnesium-block, 401-cu-in. diesel truck engine. The Roots-supercharged Cummins Diesel Special made a healthy 340 hp at 4,000 rpm, but barely qualified. On lap 50 of the race, the engine vibration damper shattered, retiring the car two laps later.

Undaunted, Cummins tried again in 1952, this time with a Kurtis-Kraft roadster powered by a 401-cu-in., 380-hp turbocharged diesel, the first turbocharged engine ever to compete at Indy. The big engine lay on its side in the chassis to lower the center of gravity and streamline the body work. Driver Freddie Agabashian captured pole position with the diesel roadster and, in the process, upped the record for single-lap qualifying speed to 139.104 mph.

But victory once again eluded Cummins when an ill-placed turbocharger inlet plugged with tire rubber particles and choked the engine after only 70 laps. It would be the last time Cummins fielded an Indy car. **MD**