



Ford GT Supercar with Extruded Aluminum Space Frame

THE ONE: A Blast from the Past



# ALuminum Extrusion

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I N N O V A T I O N S T A K I N G S H A P E

## FORD GT SUPERCAR WITH EXTRUDED ALUMINUM SPACE FRAME REVOLUTIONIZES HOW SPORTS CARS ARE DESIGNED AND BUILT



*GT's extruded aluminum space frame makes automotive design history.*



### High-Powered Design Revs Up Excitement for Nostalgic GT Racer, Sets Advanced Technology Standards and Makes Automotive History

From the introduction of the Ford GT concept car at Ford's centennial celebration in 2003, to its production line debut as Ford's flagship brand in 2004, Ford design engineers have raised aluminum technologies to a new threshold. Ford's design team, working closely with extruder Hydro Aluminum North America, has developed an all-new extruded aluminum space frame as the foundation of its legendary redesigned and re-engineered 2005 Ford GT. The supercharged MOD 5.4-liter V-8 engine produces 550 horsepower and 500 foot-pounds of torque.

Ford's "dream team" of designers and engineers are pioneering advanced technology for the GT program.

The new GT, though it has every bit of its namesake's sleek, racy look, features an aluminum extruded space frame. The all-aluminum chassis, unheard of in the GT's heyday in the 1960s, uses extrusions to connect four corner castings to one behind the passenger compartment, creating a rigid, strong and lightweight welded frame.

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*From concept car to market: Unprecedented teamwork between Ford designers, engineers and Hydro Aluminum's extruders make the new GT a reality in record-breaking time.*

When the GT40 concept car was unveiled, *Motor Trend* editors launched a "Give us the GT40" campaign, sparking an overwhelming reader response urging Ford management to put the GT back into production. The Ford engineering team employed unique technologies and processes to transform the GT from concept car to market production in a record-breaking 12 months. Unprecedented teamwork between designers and engineers forged a GT production car that retains 98 percent of the concept car's original design.

Computer modeling was used during chassis and body development and crash testing to shorten the timeframe, cutting prototype requirements by 90 percent. To meet performance targets for static and dynamic body stiffness, the team created new joining and assembling technologies, and developed an industry-first aluminum shim-nut system to attach and locate body panels in proper position relative to the extruded space frame.



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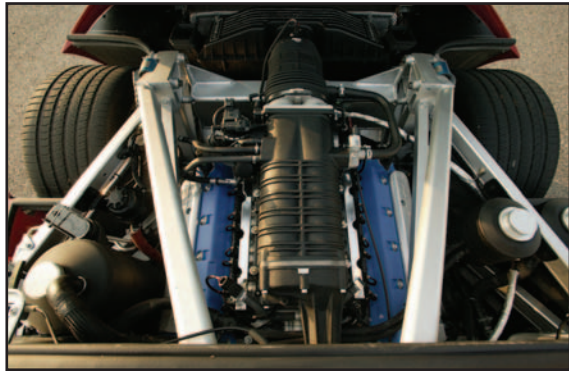
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The aluminum space frame chassis includes: 35 extrusions, 30 of which were developed for Ford; multiple stamped aluminum panels; five complex castings; and four semi-solid formed castings, which anchor the corners and serve as mounting points for a double wishbone suspension. The chassis features unequal-length extruded control arms and coil-over spring-damper units to accommodate its low profile. In addition, bolt-on extrusions structurally support the engine compartment and are integrated into the bumper assembly. The rear sport bar is also extruded aluminum.



"The relationship between designer and extruder is critical, particularly regarding the extruder's ability to meet design tolerance and material property targets," according to Matt Zaluzec, Ford's Manager of Materials Research and Advanced Engineering.

Huibert Mees, Ford GT Chassis Systems Supervisor agrees: "We worked closely with our aluminum suppliers to develop tighter specifications for wall thickness tolerance and twist, to ensure proper fit and finish for the final product."



The GT's unique extrusion designs resulted from a close collaboration between Ford's team and Hydro's extruders. They worked extensively to analyze specs, fine-tune modifications, and adapt dies to meet profile shape or thickness changes and welding heat requirements.

"The working relationship was critical to achieve a design that allows a balanced flow, optimizing part stability and die longevity," explains Adrian Elliott, Advanced Body Construction Group Leader, Manufacturing & Processes Department at Ford Research & Advanced Engineering. "Extrusions provide a clean and open design, allowing access to all trim and hardware, and facilitating easy component change and part modifications during the pre-production build."

*Advanced extrusion technologies are key to the Ford GT achieving high-performance supercar status.*



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*The rigid extruded aluminum space frame meets tight specifications for handling, weight and safety considerations.*

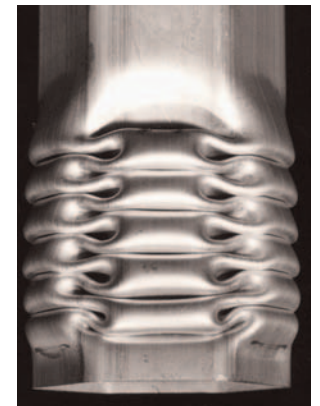
Mees points out the key role aluminum extrusions play in bringing the GT phenomenon back to the road: “Extrusions are easily integrated into the vehicle’s visual design. Many of the extrusions are designed with visual details that enhance the car’s aggressive appearance. Many of the aluminum extrusions are seen in the passenger compartment and through the rear deck.” Mees set aggressive torsional stiffness targets for world-class body control, while maintaining a lightweight vehicle to reach performance and handling targets.

Space frame rigidity was critical: “Extrusions can be designed to provide optimum structural performance, allowing individual wall thickness adjustments to meet bending stiffness requirements. The extrusions are particularly effective in absorbing energy during a crash,” Elliott notes. Front and rear extruded aluminum crush rails are bolted to the frame, removing easily in case of a low-speed impact.

The GT uses super-plastic formed aluminum outer body panels, roll-bonded aluminum floor panels, a friction-stir-welded center tunnel, a capless fuel filler system, and a polished aluminum engine cover. The aerodynamic package includes a front splitter, side skirts, completely enclosed underbody, rear spoiler, and under-car venturi tunnel, providing 300 pounds of down force at 130 miles per hour—one of the lowest lift-drag ratios on a production car.

Zaluzec observes, “The use of aluminum throughout the GT helped to reduce overall vehicle weight, thereby reducing fuel consumption and emissions generation.” Elliott also touts the advantages of lightweight aluminum components in the GT: “Aggressive targets were set for weight and performance, directly influencing fuel consumption. These targets could not have been achieved without using extrusions.”

Cost effectiveness is an important consideration. Zaluzec says, “The tooling required to produce aluminum extrusions is extremely inexpensive, especially compared to the stamping tooling of a more traditional body structure. Once tooling is complete, long extrusion lengths are easily made at moderate cost. Extrusion cross-sections are tightly tailored to the applications, minimizing material waste and weight. All these characteristics are key to producing a low-volume vehicle that, although it competes in an expensive price class, must meet stringent cost and investment targets.”



*Extruded aluminum crush rails absorb energy, protecting passengers from crash forces.*



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*Only 1,500 Ford GT supercars will be produced each year.*

These Ford experts assess aluminum extrusion's potential for cars of the future: "With the cost of steel rising and demands for more fuel-efficient vehicles increasing, aluminum will continue to play an important strategic role in reducing vehicle weight," Mees says, "Aluminum extrusions offer one of the lowest investment options for getting aluminum into the vehicle."

Elliott adds, "Extrusions will remain dominant in the low-volume arena due to low tooling investment. At higher volumes, selective use of extrusions may be integrated into conventional unibody architectures to save weight and improve specific performance. Hydroforming will be used to optimize profile shape, to assist in this integration."

Ultimately, says Zaluzec, "The flexibility in design of the extrusion cross-sections meets our various design demands. We were able to tailor wall thickness exactly to the demands of each component, to keep overall weight to a minimum." Elliott agrees, "The complexity achieved in each individual extrusion allowed optimum joint and sub-assembly performance. Extrusions are becoming the norm for sports cars, particularly supercars, due to performance and investment requirements."

Industrywide, many new automotive designs are incorporating more extruded aluminum and aluminum-alloy components into frames, suspensions, chassis, engine blocks, radiators, cylinder heads, bumpers, and side impact beams. Aluminum extruders are at the forefront of this trend, supplying key parts to automakers for newly designed vehicles. Automobiles using significant aluminum design elements include: the 2005 Aston Martin DB9; the 2005 BMW 6 Series; the 2005 Lotus Elise; the 2005 Pininfarina Enjoy; the 2005 Subaru Legacy; the 2005 Subaru WRX STi; the Ferrari 612 Scaglietti; and the Jaguar XJ. Pound for pound, aluminum is stronger than steel, and as engineers attest, "...aluminum meets the same federal crash standards as steel, given the proper design and construction methods."



*On the road again: The GT supercar combines winning technology, design and appeal.*

For more information on aluminum extruders, request your free copy of the AEC Buyers Guide at [mail@aec.org](mailto:mail@aec.org).



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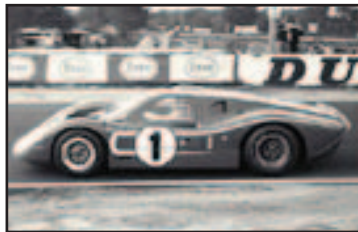


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S H O W C A S E

I N N O V A T I O N S T A K I N G S H A P E

## “THE ONE”: A BLAST FROM THE PAST STEERS A FAST AND FURIOUS DRIVE INTO THE FUTURE



In the 1960s, the sports car line collectively known as GT40 became a 20th century racing icon. It was the fastest sports racing car of its day—the first to exceed 200 mph on the Mulsanne straight at Le Mans.

Now, the legend is reaching a new echelon with production of the 2005 Ford GT. The \$140,000 sports car is launching the biggest wave and most aggressive rollout of new products in Ford's history. It made its television debut in a swirl of hype at the 2004 Super Bowl. It's been grabbing international headlines ever since, with celebs like *Tonight Show's* Jay Leno and NASCAR hot shot Matt Kenseth parking this supercar in their own driveways.



Jay Leno gives his new FORD GT a thumbs up. At 200+ mph, Leno proclaims his GT Supercar is "faster than fast!"

Though it is a low-volume production vehicle that is sure to be a rare sight on the road, Ford is calling the 2005 GT "The One," and billing it as the "pace car for an entire company." They've dubbed it a retro-techno vehicle—in essence a remake of the nostalgic vehicle for today's market.



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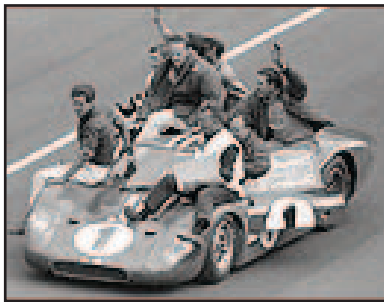


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“The Ford GT was built by people who love great cars, and Ford Motor Company is full of people who share the same passion but work on our high volume cars, SUVs and trucks,” said Carter Balkcon, marketing manager for the Ford GT. “That’s why it’s the company’s pace car, and that’s the spirit we think we have captured in ‘The One’. It’s our big buzz of excitement and represents Ford’s rebound from tough times to back on top as the industry leader and pace setter.”

Here is a look at memorable moments in the GT’s history, and a glimpse into the future through the eyes of two racing greats, then and now: Ford race car drivers Willy T. Ribbs and today’s hot star, Keneth, guys who casually navigate life on and off the race course at high speeds. They know their cars, and they know all about winning fast and furiously.



## A Racing Icon is Born

**1960s:** The Ford GT40s of the 1960s, developed on the orders of Henry Ford II, challenged Ferrari for road-racing supremacy. The challenge turned into a rout in 1966, when Ford GT40s crossed the finish line 1-2-3 at the 24 Hours of LeMans—wins that helped Ford earn the World Manufacturer’s Championship for sports cars. Next, a debut race at Nurburgring; first place at Daytona Continental and continued LeMans wins.

**1968:** Historic first place win by Shelby American Mark IV in the 24 Hours of Le Mans. Ford wins at Le Mans for the fourth consecutive year.



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## A Blast from the Past: Willy T. Ribbs



Racing pioneer Willy T. Ribbs says, "The GT40 changed Ford's image forever."

When Willy T. Ribbs entered the racing scene in 1977 driving Ford Formula Cars, he remembers fondly how the Ford GT40 made the Ford name sporty throughout the industry. An auto-racing pioneer who made sports history by becoming the first African American to qualify and race in the Indianapolis 500, Ribbs' 25-year career began when Edsel Ford drafted him to drive Ford Formula cars in Europe.

Ribbs was at the top of his field, racing for such winning teams as Dan Gurney, Jack Roush and Derek Walker. He won more than 40 races in such series as SCCA Trans-Am, CART/Indy Car, NASCAR, and Formula Ford in Europe. One of Ribbs' most notable sponsors was entertainer Bill Cosby, and his career has crossed interesting paths with such notables as Muhammed Ali, Vice President Dan Quayle, Paul Newman, Clint Eastwood, Jay Leno, Colin Powell, and many others.

Ribbs, who started driving tractors on his family's farm in San Jose, California, says until the Ford GT, he always thought of Ford cars as "trucky-looking sedans." The GT changed all that, he recalls and says, "Back then, I felt like I was behind the wheel of a sporty Corvette."

In "race-talk," Ribbs acknowledges the lighter feel of those aluminum extruded vehicles, which he test-drove during practices. In the pits, he says, is where the car's construction made a significant impact for his crew and supporting mechanics on call. "I kind of wrecked a lot of cars during practice, but with the aluminum framing, the crews could whip out a new mold and have me back on the track in no time. It made a huge difference," recalls Ribbs. "We'd keep 100 or so of those body molds around just for that."

Ribbs says the GT is one American car that goes way beyond just a muscle car, into the realm of a Le Mans-worthy supercar that "is worthy of its predecessor."

These days, Ribbs, 49, often serves as a commentator for auto racing coverage. An autobiography is in the works on his life story, *Unbrakeable*, and Columbia Pictures and actor Michael Douglas purchased the rights to Ribbs' life story for a future movie. Ribbs has appeared on several television programs including the *Tonight Show* with Jay Leno, HBO special with Bryant Gumbel, MTV's "True Life: I drive race cars" and the ESPN special, "A Forgotten Race." Ribbs' acting debut was opposite David Caradine and Mariel Hemingway in the major motion picture *American Reel*. Currently, he's starring in a pilot remake of *Paper Dolls*.



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## 2 Fast, 2 Furious: Ford GT Back on Track

**2002:** A concept version of the Ford GT is unveiled at the 2002 North American International Auto Show in Detroit. That spring, Ford approves the car for production. Ford's "Dream Team" begins work, bringing concept to market in a record-breaking 12 months.



**2003:** The first production-level cars are unveiled at Ford's Centennial celebration in June 2003. Updated Ford GT concept vehicle is featured at 2003 North American International Auto Show. The car's desirability is underscored later that summer at the Christie's Auction of Exceptional Motor Cars at Pebble Beach, CA, when one of the production line's first Ford GTs is sold for \$500,000 (plus auction fees), with net proceeds going to charities.

**2004:** The aerospace-inspired 2005 Ford GT supercar wins at speeds over 170 miles per hour, in a race against a CAP 232 aerobatic plane at the world's largest air show, AirVenture.





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## Back to the Future: 2005 Matt Kenseth

In *NASCAR 2005: Chase for the Cup*, the video game, you'll run into Matt Kenseth, the 20-something kid who was a natural winner from the day he put his key in the ignition. The 2003 NASCAR Winston Cup champion who drives the No. 17 DEWALT Ford for Roush Racing is the first Ford driver in the game's countdown and a muscle car fanatic in real life. In the video game, Kenseth cruises the city streets in his sweet Ford GT, a 550-hp monster powered by a super-charged V-8 with four valves per cylinder.

*"This is a true race car,"  
proclaims NASCAR superstar  
Matt Kenseth.*

On his home turf, Kenseth commands the wheel of his Ford GT, a gift from The Ford Motor Company when he held the Winston Cup points lead for a record 33 straight weeks before ultimately being crowned the Winston Cup champion. His winnings: a cool \$9 million and the keys to a Ford GT, which was delivered to him late in 2004.

"It's cool," says Kenseth, "That's one of the neatest things that I've received for winning the championship."

Kenseth says about the Ford GT: "This is a true race car. We're right on the ground, which is where you need to be. The gauges are laid out perfectly, and the seats are deep and the gearshift is high. The engine sounds great, and I like how you can feel the car flatten to the ground as you pick up speed. The aerodynamics of a high-performance machine like this is important. The pickup is just like a race car—it eases from first to third no problem, and it takes the turns well."

For some racers, it takes years to earn their first victory. For Kenseth, it took two races. The Wisconsin native started racing at age 16. By the time he turned 19, he became the youngest ARTGO Challenge Series winner in history. By age 23, Kenseth had already gotten his first NASCAR experience as he tackled the All-Pro Series.

By the time Kenseth moved up to the Busch Series in 1997, he was used to hanging out in the winner's circle. The winning continued as Kenseth scored seven top-10 finishes as a rookie and then went on to earn his first three Busch wins a year later taking 17 top-five and 23 top-10 finishes, and proving once and for all that there is no sophomore slump.



*Big Win: The GT leads the list of prizes for Kenseth's racing victories.*

If you have an application story to share, email the Showcase staff at: [mail@aec.org](mailto:mail@aec.org)



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