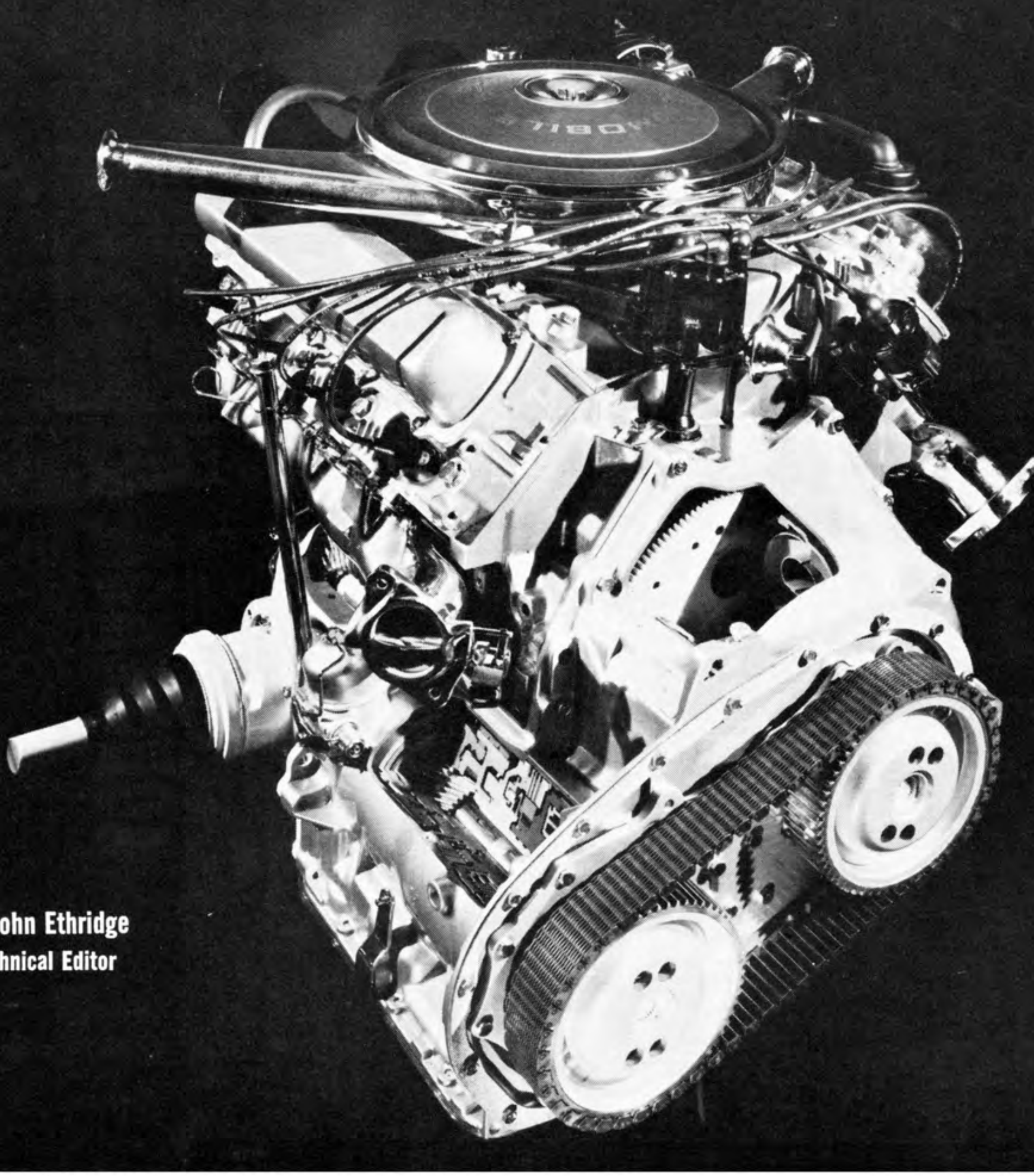
ENGINEERING THE TORONADO

In effect, Olds engineers were told: "Design a car—any kind of car—so long as it's better"



by John Ethridge
Technical Editor

From left: Chief Engineer John Beltz; Assistant Chief Engineers Robert Dorshimer, H. H. Kehrl, and J. H. Lewis; Executive Engineer Donald Perkins; and Advanced Design Engineer A. K. Watt. These top Olds engineers played key roles in the program.

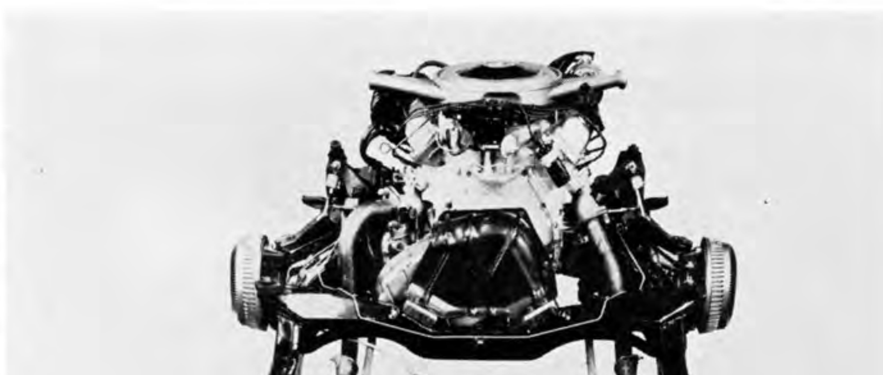
IT'S RELATIVELY rare in this day and age for any company to explore largely uncharted waters and bring out a design like the Toronado, that contains so many new and unconventional features. (Although fwd is by no means of recent origin, little was known about it compared to front engine/rear drive or even rear-engined cars.)

The object of the Toronado undertaking was *not* to create a "weird-o" merely for the sake of being different. Olds' chief engineer, John B. Beltz puts it this way: "The Toronado venture was born of a desire to create a better automobile – one with more usable room and roadability. . . . We were after a big step forward and were willing to break new ground in order to get it."

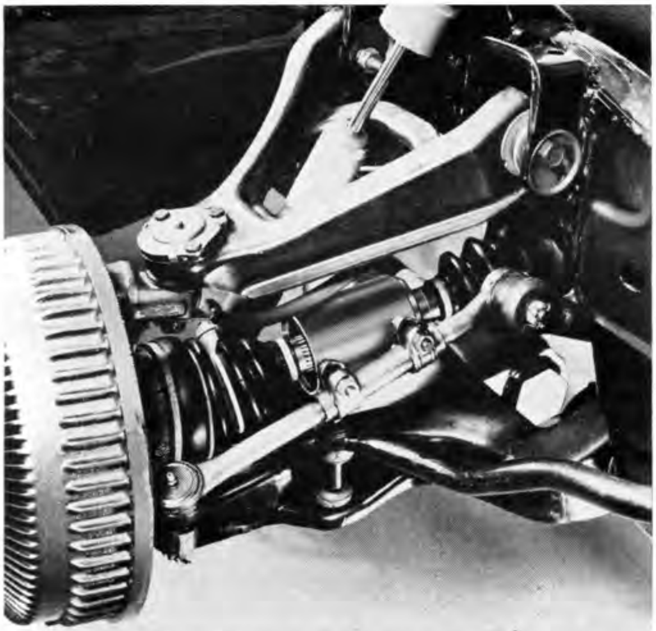
The first spadeful of ground was turned in 1958, shortly after Olds' Advance Design Group was given a mandate to investigate new arrangements with an eye to coming up with a better car. Several configurations, among them front-engine/rear-transmission designs, were studied. Some engineering prototypes were built and tried.

By early 1960, the engineers arrived at the front-engine/front-drive layout as the most promising. But thinking centered around a small, F-85-like car. (Remember, at that time, everyone was thinking compact.) In appearance, it was quite similar to the early Corvair. With good reason, too, because the body was actually pieced together from Corvair parts.

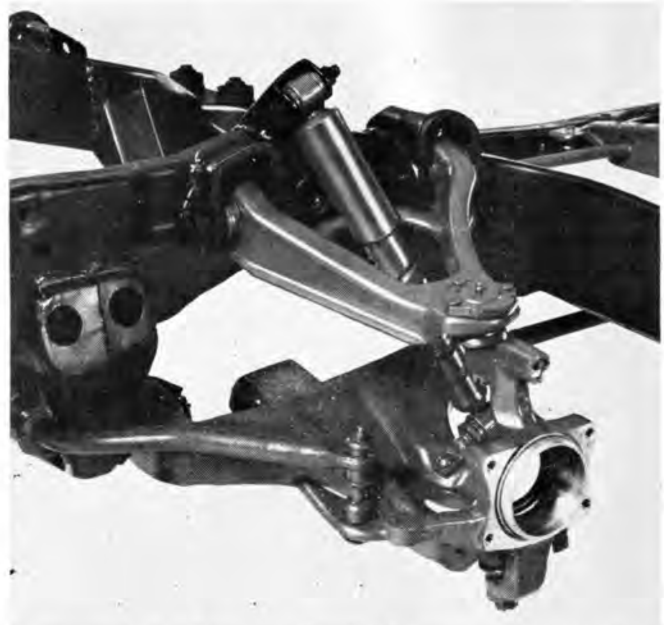
This one had a 215-cubic-inch V-6 aluminum engine mounted *crosswise*. It used *two* chains, one connecting engine and transmission and the other the transmission and differential. The car was



Rear view of chassis and power train shows under-frame extending only as far as front of rear springs. Dual exhausts using common silencer housing are standard equipment.



Part of secret of Toronado's smoothness and good manners is presence of torsional damper (center of picture) in driveshaft.



Very rugged, rigid suspension members maintain correct geometry. Outboard mounting makes shock absorbers more effective.

Extremely simple rear suspension consists of 2 usual shocks, plus 2 for braking wind-up, hat section axle, single-leaf springs.

Standard power-assisted steering plus hydraulic steering damper (arrow) provide effortless steering and eliminate fight-back.

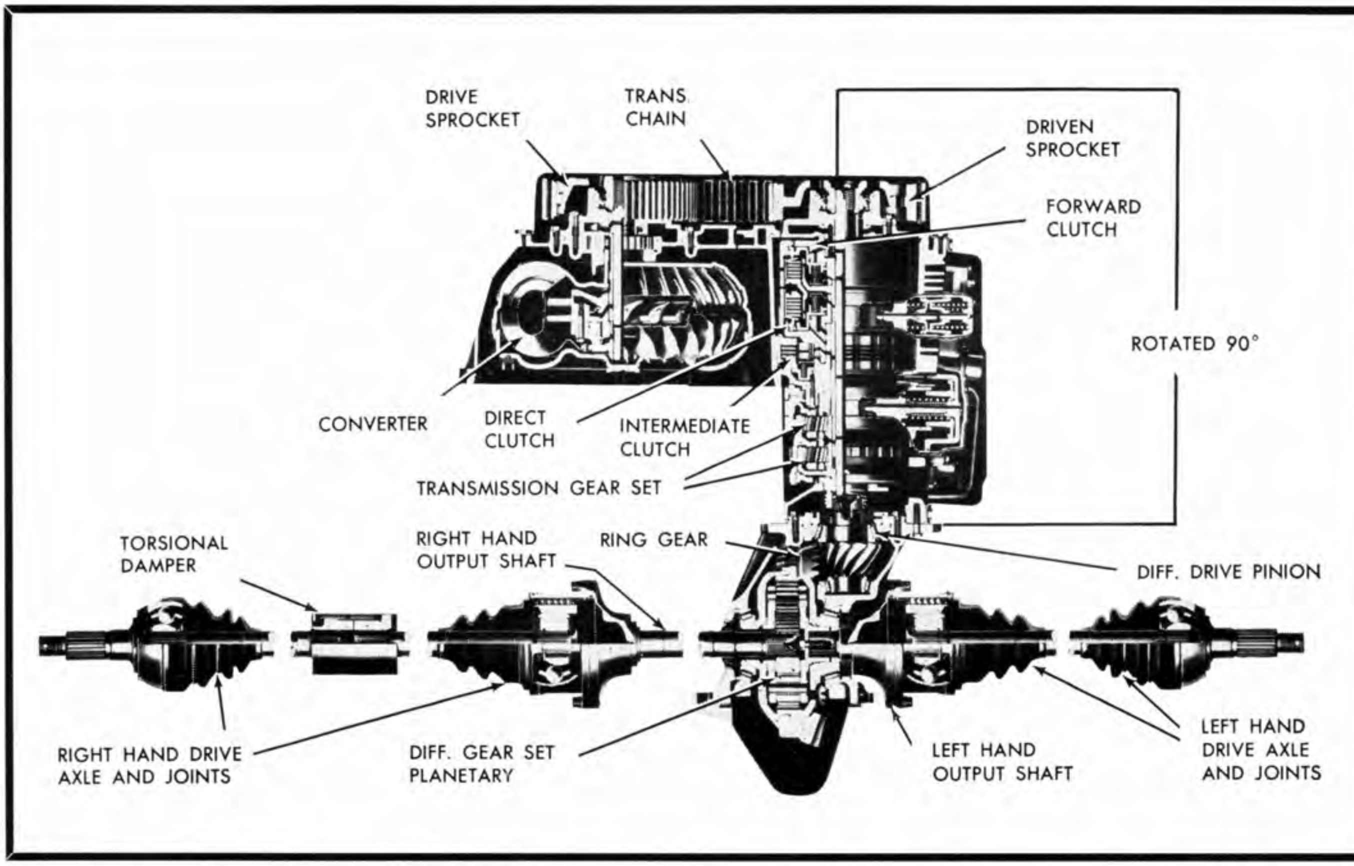
very encouraging from the standpoints of directional stability, handling, and general performance. But it served up some knotty problems that were to require much time, money, and effort to solve. Shudder, chain noise, universal joint reliability, and a host of subsidiary considerations ultimately taxed the ingenuity of virtually every member of Oldsmobile's engineering staff.

Gears and steel-reinforced, toothed, rubber belts were investigated as alternatives to chain drive. But the gears were also noisy, and the belts didn't last long enough. Chain life, while good from the beginning, was further improved by having power flow through the torque converter before entering the chain, benefiting from the cushioning effect.

While the development program was underway, there was a change in plans as to the class of fwd car that would be built. A marketing survey indicated buyers in the luxury-personal or sports-car price class were most willing to try something new. Effort was then concentrated on a full-sized car powered by a large V-8 engine. By mid-1961, initial concepts for such a car had been formulated. It featured transversely mounted engine and transmission, with a planetary differential and inboard disc brakes.

Up to this point, coil springs, mounted above the upper control arm, had been used on the front suspension. These were abandoned in favor of torsion bars to lower the silhouette. Because of space limitations imposed by the crosswise engine, these were of a laminated design only 18 inches long.

The next major evolutionary step was to abandon the transverse engine setup in favor of the conventional longitudinal arrangement. This solved many problems, such as simplifying the cooling system and fan drive and giving the suspension more sorely needed space. Sim-



Power flows from torque converter bolted to flywheel through silent chain to 3-speed Turbo Hydra-Matic transmission, then through spiral-bevel (not hypoid) gearset to all-spur gear differential. Ball-splined inboard joints permit axial movement.

PHOTOS BY DARRYL NORENBERG, GM

Conferring at early fiberglass model showing are (from left): Stan Wilen, Olds styling chief; Olds Chief Engineer John Beltz; Ed Donaldson, chief interior designer; and Charles M. Jordan, in charge of automotive design, General Motors styling staff.

ple long, solid torsion bars could now be used.

But as is often the case with a sweeping design change, old problems were solved and new ones introduced. The thorniest of these arose from changes in the oil pan to allow the right driveshaft to pass under the center main-bearing cap. At first, a tube was welded in the pan and the shaft passed through it. This was abandoned in favor of a pan with a hump in it where the shaft is, because the old pan would be expensive to produce, was a potential source of leaks, and allowed oil to surge forward when going downhill or braking.

But their troubles were far from over. The new pan trapped oil in the forward section. The oil foamed when stirred by the crank and rods, causing the hydraulic valve lifters to leak down. After making a clear plastic pan to observe what was going on inside, the engineers finally solved the problem with a system of baffles and troughs stamped into the pan and other changes in the oil returns.

Meanwhile, chain noise had been reduced to an acceptable level by such devices as randomly relieved teeth and rubber isolated sprocket teeth. (The final solution was to use sprockets with special thin sections and a chain with uniform teeth.)

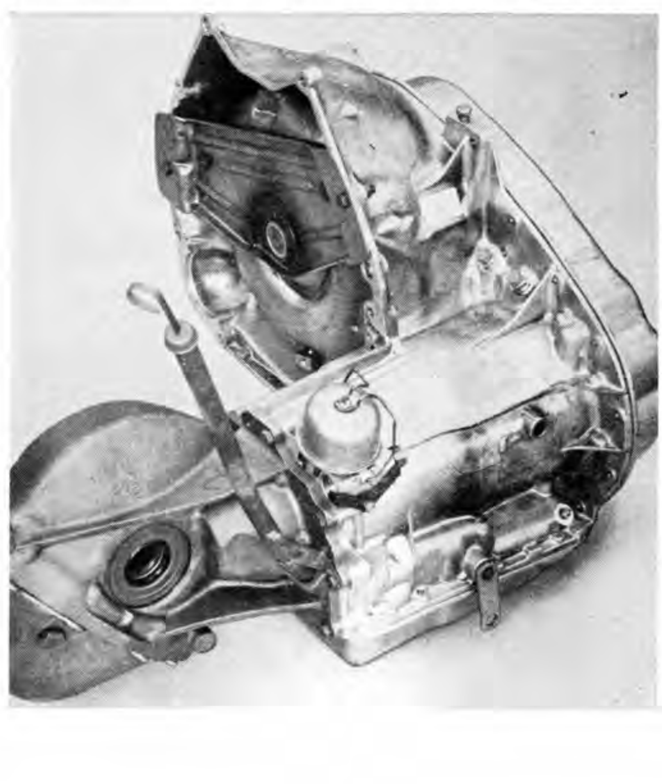
Olds now felt they had something worth showing General Motors potentates. So in February, 1964, a demonstration was held for several top GM executives at the Desert Proving Grounds in Arizona. These top leaders were duly impressed, and Olds got the green light for 1966 production.

The Toronado project left Andy Watt's Advance Design Group at this time and went to the regular engineering groups for production development. Now, the fun really began. Things like producibility, interchangeability, and cutting costs by every cent possible,

Large, finned, cast-iron drum brakes do creditable job of stopping 4800-pound car.

Spare occupies space normally taken by differential hump in conventional cars. Despite truncated rear styling, Toronado has roomy trunk. Deck lid's counterbalanced with springs.

(ABOVE) *Although final pan design's rather simple and straightforward, problems with oil frothing created major challenge.*



(RIGHT) *Bell housing/transmission die-casting, stamped chain cover, and cast-steel differential case make compact assembly.*

normally given secondary consideration in a research and development program, were the order of the day. Also, there were many more miles of test driving and thousands of hours spent on laboratory fixtures before the Toronado you can buy became a reality.

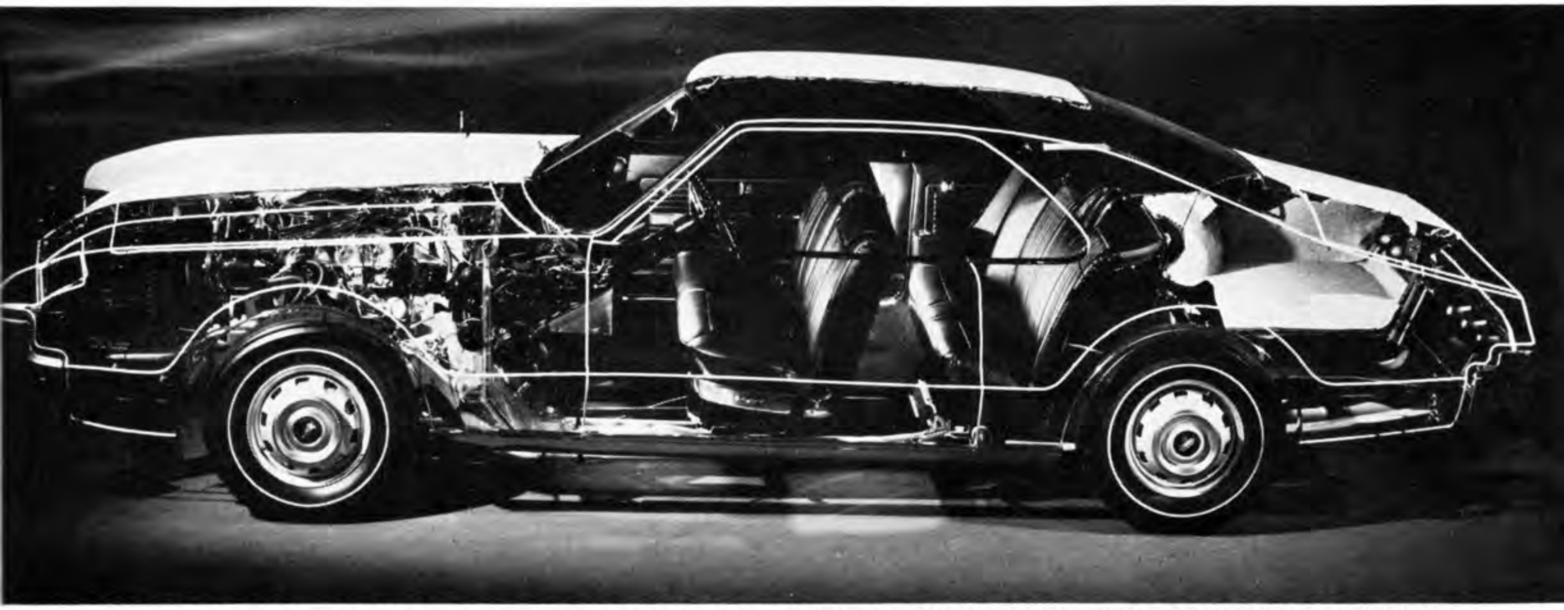
If Olds hadn't set their sights so high on the Toronado project and had been willing to accept a few compromises here and there, they could've saved much time and money. But they were looking at the long-term aspects. Had they offered a car with a few fwd idiosyncrasies, say, they'd have run the risk of buyers turning their backs on the car and every nickel put into the project going down the tubes. Instead, they invested enough to make doubly sure that the Toronado would be highly perfected and a milestone in automotive design.

We were amazed to learn that fairly early in the Toronado program a separate but parallel project was initiated by the GM corporate engineering staff. This was no snafu – just GM's way of not putting all its eggs in one basket. It was done with full knowledge of and interchange of ideas between the two groups.

Probably only GM and the U. S. government could afford this sort of luxury. Of the two, maybe only GM could've done it as efficiently.

There was a kind of friendly rivalry between the two groups, resulting in much benefit to the Toronado program. John Beltz credits "staff" with many valuable contributions, among them evolving a better system for mounting the Toronado engine. He's also grateful to them for helping sell top management on the program.

As we left Olds' engineering building, we thought of something John Beltz had said: "The Toronado project was relatively free of restrictions and furnished our engineers a once-in-a-lifetime opportunity to show what they could do." History will record that they made the most of it. /MT



PHANTOM CUTAWAY REVEALS GENERAL ARRANGEMENT OF TORONADO COMPONENTS. PORTION OF BODY BEHIND REAR PASSENGERS IS UNITIZED.

Photos above and at right show attention given to one design parameter neither engineers nor stylists can change – the human anatomy. Creature accommodations and comfort figure into auto design today to a much greater extent than a few years ago.