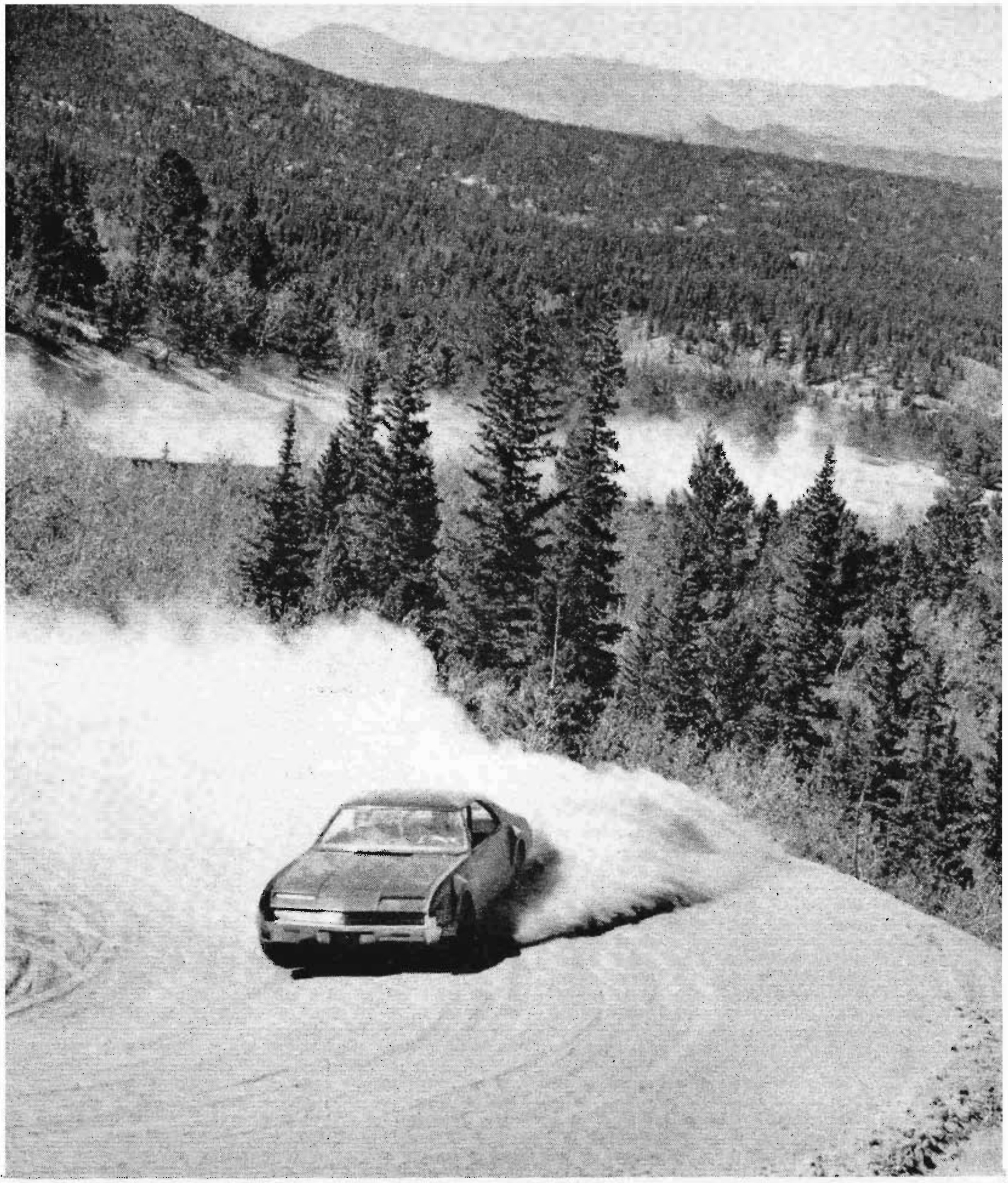


TORONADO AT THE PEAK

Oldsmobile builds the Toronado's performance image with a rapid run up Pikes Peak

BY ROGER HUNTINGTON

There's an old wives' tale to the effect that a front-wheel-drive car can't climb hills. Not on loose gravel anyway. The old wives in question say that the rearward weight transfer—resulting both from the car's nose-up attitude and from the reaction to acceleration—un-loads the driven front wheels to such an extent that they can't get any traction, and the tires just claw helplessly at the road. When Oldsmobile brought out their front-wheel-drive Toronado, the fellows in Lansing, Michigan, were hoping it wouldn't be true of this car. Realizing that this design would be fair game for the critics, Oldsmobile decided to prove the Toronado's practicality for everyday driving (and score a few points for the ol' performance image too) by having a shot at that infamous stretch of gravel, sand and snow that snakes up Pikes Peak.

The idea for the hill-climbing run was Ted Louckes', the assistant head of experimental engineering at Oldsmobile. He was

CONTINUED

in a position to undertake this project without ruffling any anti-racing feathers on GM's Mahogany Row in Detroit. It wasn't a race anyway—only against the clock. And the stunt seemed like a natural to prove some of the tremendous traction potential of this fwd design.

It's history now that the run was a complete success. Driver Bobby Unser turned the wild 12-mile course in 14:09.9—which was within 17 seconds of Parnelli Jones' all-out stock car record in a Mercury two years ago. Traction was all that was hoped for, but the project taught Olds engineers lessons about the handling and roadability of their new toy in rough mountain driving that would've required months of proving-ground testing to learn.

And don't minimize Unser's part in the game. He was more than just a skilled driver who knew the hill. "We couldn't have tackled this without Bobby," says Louckes. "His knowledge of setting up a car for the hill was as valuable as his driving ability. Our boys hardly knew where to start to modify for traction on gravel—we would've done almost exactly opposite to what Bobby suggested—and it would have required literally weeks of testing to sort things out by trial and error. Also, Bobby's ability as a test driver amazed us. He could run a certain section of the course at times that wouldn't vary more than a couple of tenths—and then tell us exactly what had to be done to the suspension to get absolute minimum time. He drives at ten-tenths all the time on that hill. And there was no question in his mind when the car was right: he said, 'That's it,' and was perfectly confident that there was no way to get that particular car up there any faster. The kid is something else."

Setting up the Toronado suspension for maximum bite on those gravel turns was probably the most interesting part of the project. It's just the opposite to what you would do on dry pavement, because the effective traction coefficient is so much lower on the gravel. It's almost like setting up a low-powered car to get around on ice. The key here is to *increase* body roll! On the Toronado, they ended up using a smaller front anti-roll torsion bar and 25 per cent softer springs and shocks all around. The anti-roll bar they brought along to put on the rear proved to be a hindrance. The suspension ended up absolutely flabby.

Picture the effect of this flabby suspension on a gravel turn. What they were doing, in effect, was to let the work required to roll the sprung mass absorb some of the centrifugal force that would otherwise lift the inside wheels. Keep in mind that this is strictly a *momentary* effect—what engineers call a "transient" condition. In a long high-speed turn, where the body settles down in a fixed attitude, this hefty roll effect would *hurt* the cornering power. But when you're wheeling a heavy car back and forth through tight switchback turns, body roll can have a big effect on instantaneous wheel loads. In a word, when the car is wallowing around, the tires are staying on the ground. The roll inertia of the sprung mass is absorbing centrifugal force, at least for that first second or so as the car enters a turn. And on tight turns like these, the car is almost through the turn before the sprung mass settles down. Think about that a second. If they had set the Toronado up with tight suspension and minimum roll, the inside tires would have been sliding the split-second the driver changed direction.

Oldsmobile engineers didn't know about this. Bobby Unser did. Unser also knows, as do all dirt track drivers, that maximum traction is obtained by transferring as much weight as possible to the outside wheels. In dirt track cars, this is accomplished by building them tall; with a high center of gravity, centrifugal force presses the outside wheel onto the surface. In a car with a low center of gravity, the only way such lateral weight transfer can be accomplished is by having such a loose suspension that the body heels over and leans extra weight on the outside wheels. So the flabby suspension of the Pikes Peak Toronado had a double beneficial effect: good transient response and better weight transfer, but the latter comes into effect after the transient condition is over and the car has settled into a stable attitude, as during a long, sweeping turn.

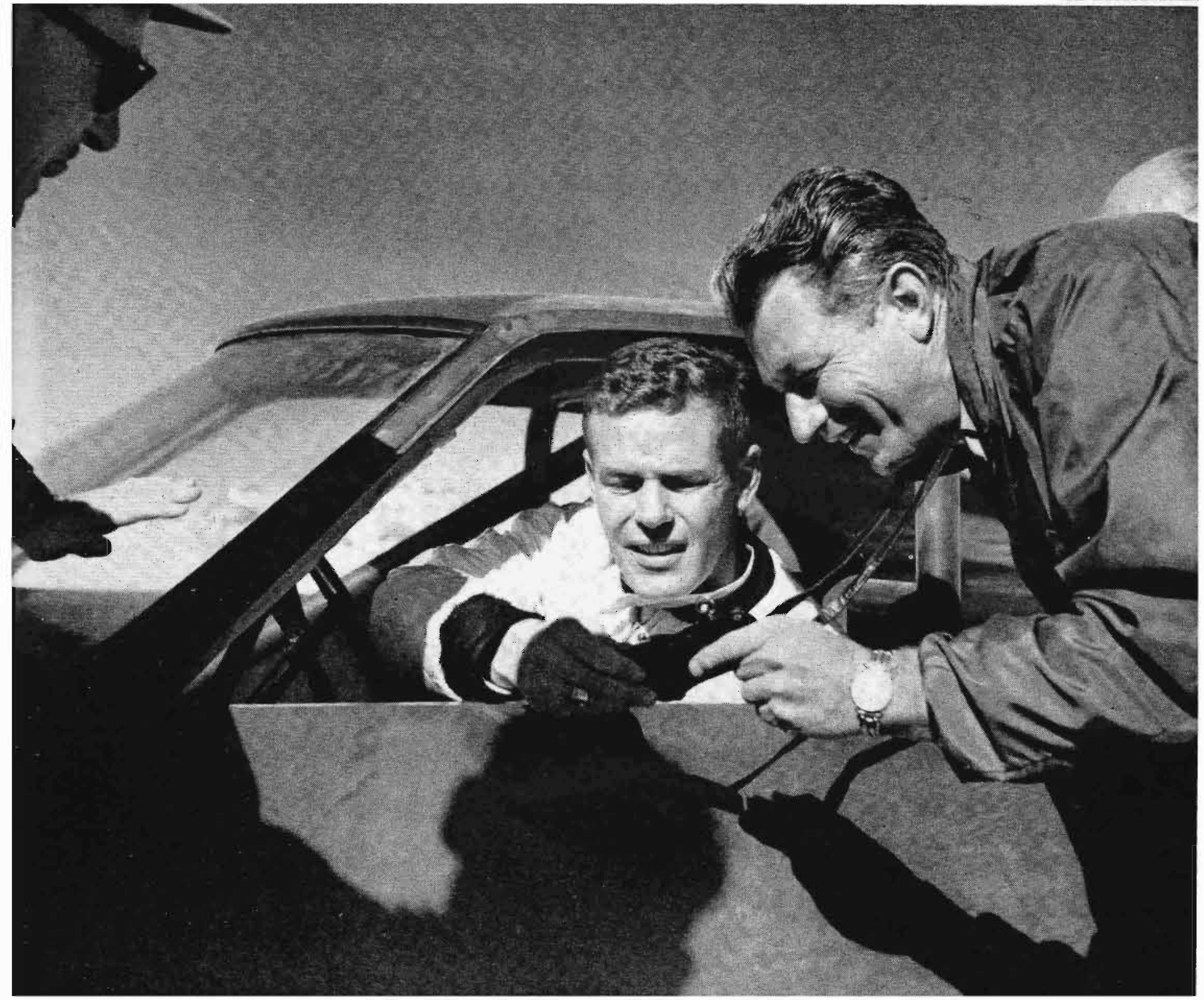
Climbing a hill is something like acceleration in that the car's weight-to-horsepower ratio is the prime performance parameter (except that you're lifting a mass as well as accelerating it). Thus Olds' major aim on the Pikes Peak Toronado before it left Lansing was to cut the weight as much as possible, and hop up the engine a little—within the USAC rules defining a "stock" engine. The weight-cutting program was amazing—they took out more than 1000 pounds. The body was completely stripped and gutted, even to many of the body bracing members. And a lot of weight was taken out of the frame. They ran a "Stresscoat" test first, applying a thin plastic coating on all frame members, then subjecting the frame to normal running stresses. Points of maximum stress can be easily read by noting the cracks in the plastic coating. So Olds engineers just whacked out the areas of minimum stress. Frame weight was cut over 100 pounds without seriously weakening it. The steel hood, front bumper and rear deck lid were replaced with fiberglass duplicates, and the heavy front and rear windows were replaced by plexiglass. The inner fender panels were "Swiss-cheesed." The instrument panel was replaced by a few rudimentary gauges on an aluminum panel, and the seat was just a light fiberglass bucket.

They managed to get the weight down to

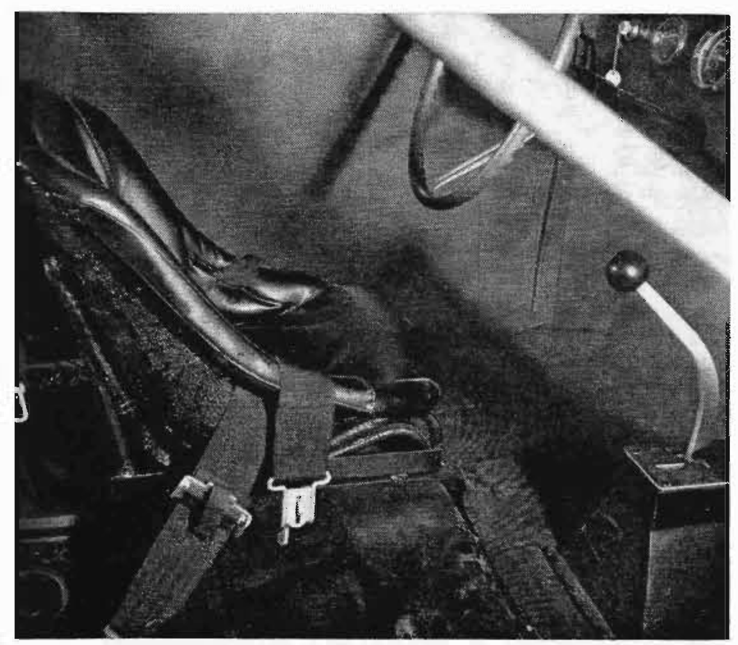
(Continued on page 82)

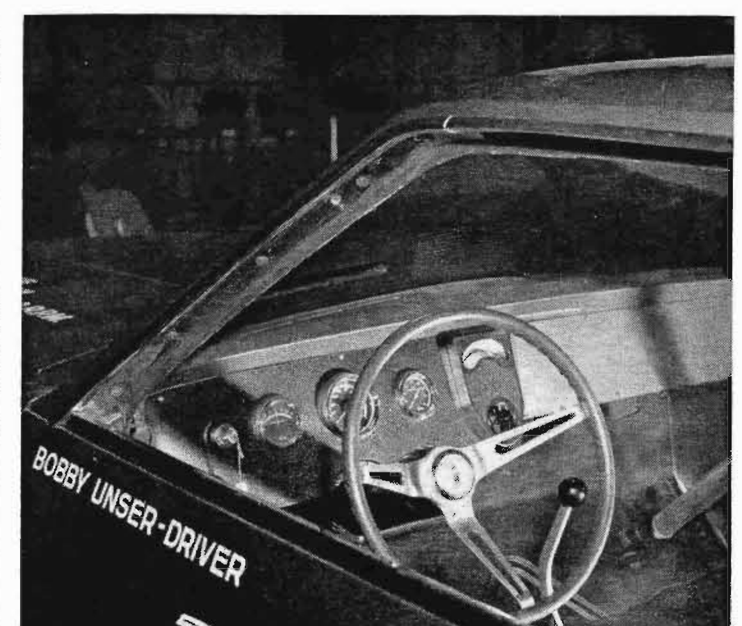
Veteran Pikes Peak competitor Bobby Unser checks his time after the run. He climbed the hill just 17 seconds slower than the stock car record.

GM PHOTOGRAPHIC



This was no stock Toronado. The interior was gutted and liberal amounts of weight were removed, in accordance with USAC stock car regulations.





TORONADO *(Continued from page 53)*

3400 pounds from 4500, and slightly increased the percentage of weight on the front driving wheels, from 60 per cent to 62-63. All to the good.

The engine was a routine hop-up job. USAC rules say you can do anything inside, as long as you're under 427 cu. in., and carburetion can be only a single four-barrel. Modifications included a hotter experimental hydraulic cam that would permit 5500 rpm in the gears, milling the heads for 12-to-one compression, porting and polishing, increased clearances, careful balancing of the lower end, and a good set of tuned exhaust headers of steel tubing (which save weight as well as increase horsepower). Dyno tests showed a gross peak of about 410 bhp at 5200 rpm on premium pump gas—which is well over 100 bhp more than the standard Toronado engine produces as installed. (Advertised horsepower doesn't mean much outside the dyno room in Detroit.)

Other modifications: the GM Turbo Hydra-Matic torque converter was unchanged except for raising the full-throttle shift point from 4600 to 4800 rpm. Also, they made a neat floor shift lever for Unser (though he stayed in "Drive" range most of the time), that permits up- and down-shifts at will. The overall gear ratio had to be changed substantially from the stock 3.21 ratio. This proved to be a job. Space requirements wouldn't permit a stiffer ratio than 4.09:1 on the spiral bevel final drive gears, using standard differential parts. So to get an overall ratio over 4-to-one, they simply used some old prototype chain sprockets that would give a step-up ratio of 4-to-one between the converter and gearbox. Thus, the overall ratio is 1.14 x 4.09—which works out to 4.67-to-one. This was calculated to give an engine speed in high gear of 5400 rpm at the maximum anticipated car speed of 100 mph. As it was, Bobby Unser got it up to a valve-clattering 107 mph at one point.

Special tires were a key factor in the success of this climb. Olds decided to use the highly effective 7.60-15 Goodyear Pikes Peak Specials. These are designed specifically for this course, and feature a deep, snow-type tread pattern with tiny pieces of walnut shells mixed in with the tread material. The idea here is that these sharp shell pieces will keep tearing out of the tread material, and thus keep the rubber surface rough and jagged. It's possible to develop substantial lateral *g* forces with these tires—almost like normal passenger tires on asphalt. Incidentally, the tread *width* proved to be a critical factor, even though the same tire size was used all the way. They ended up with 8-inch tread width on the front and 7 inches on the rear, mounted on special 8-inch rims that were welded to standard Toronado wheel spiders. Inflation pressures varied from 24 to 30 pounds.

Olds put metallic brake linings on the car, but braking proved to be relatively unimportant on the climb, and standard linings would have done nicely. However, a very important modification consisted of replacing the standard steering gear with an early prototype unit that gave an overall steering ratio of 12-to-one (vs. 17.8 standard). This let Unser wheel through the tight turns a lot easier. Power steering was retained (standard on Toronado), with the flow orifices opened up to give quicker power response on quick wheel turns. (It's easy to "beat" a power steering system when the ratio is speeded up.)

So how did the thing handle on gravel turns?

John Fitch, sports car expert who is a consultant for Oldsmobile, was on hand and waxed rather lyrical on the handling attributes: "Maybe we were 17 seconds off Jones' all-time stock car record, but it's also nice to remember that we were almost eight seconds *quicker* than Nick Sanborn's 1965 winning time of 14:17.7 in a racing Plymouth Hemi. The interesting thing about the Toronado's cornering power and handling qualities is indicated by separating the times taken on the fast straight sections from those on the tight curving sections of the climb. Although the Toronado lost time on the fast sections where cornering and handling matter less than a brute horsepower-to-weight ratio, it more than made up the deficit in the tight hairpins and slow bends."

Bobby Unser is a man of fewer words, but those words are right to the point. "That rascal fools you. You can get on the power a lot sooner and harder than you think coming out of the turns. But the front end pulls so effortlessly that it takes a few runs to really believe it's as good as it seems. I could hardly believe some of the clocked times on certain sections. But I'm beginning to think front-wheel-drive is the answer for this hill. If you could build front- and rear-drive cars with all other factors equal, there's no doubt in my mind that the front-drive would be faster overall."

And engineer Ted Louckes had some interesting technical comments on the car's hill performance. "We made all our money in the tight turns and switchbacks," says Ted. "These areas are only a small percentage of the total 12-mile course length, but our clocked times were as much as 20 per cent faster through these areas than all-out USAC racing jobs. It was hard to believe. Of course, we lost time on the longer, faster sections because we had 100 to 200 horses less than the stock cars. Parnelli Jones exceeded 120 mph at certain points where our top speed was just about a stand-off. But it kind of makes you wonder what the Toronado could do with 600 horses!

"I took a ride through some of those tight sections with Bobby. I was on the bare floor, tangled in the roll bar, hanging on for dear life. But it was an experience.

"I think a key factor in this superior cornering with front drive is that you can point your driving thrust wherever you want it by flicking the steering wheel. With rear drive the thrust is always in line with the axis of the car. This factor isn't so important on wide, fast turns where steering angles are small, but it's a key on tight turns on gravel. And our customers will find that it's important on ice and snow."

And so went the Olds Pikes Peak project. The operation itself was a success—but what's just as important, the engineers learned something besides how to get up a hill in a hurry. For one thing, they now have a little different view of the effect of spring stiffness and roll rate on the cornering of the Toronado. I think you'll see the ride softened up a bit, maybe even before the '67 model run begins—but without any big sacrifice in handling. Also, they admit that they're interested in an anti-roll bar on the rear, to reduce the understeer tendency that is inherent with front drive. They didn't need one at Pikes Peak, but you could feel the difference on pavement. Another cute trick they tried at the Peak was to use up to three degrees negative camber on front *and* rear wheels. This could be felt on dirt, and could certainly be felt on pavement. The car seemed to like an excess of negative camber on the rear. This could be a sign of things to come.

In fact, we might not have even seen the last of the Toronado on Pikes Peak. C/D