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CAR AND DRIVER

AUG/2016

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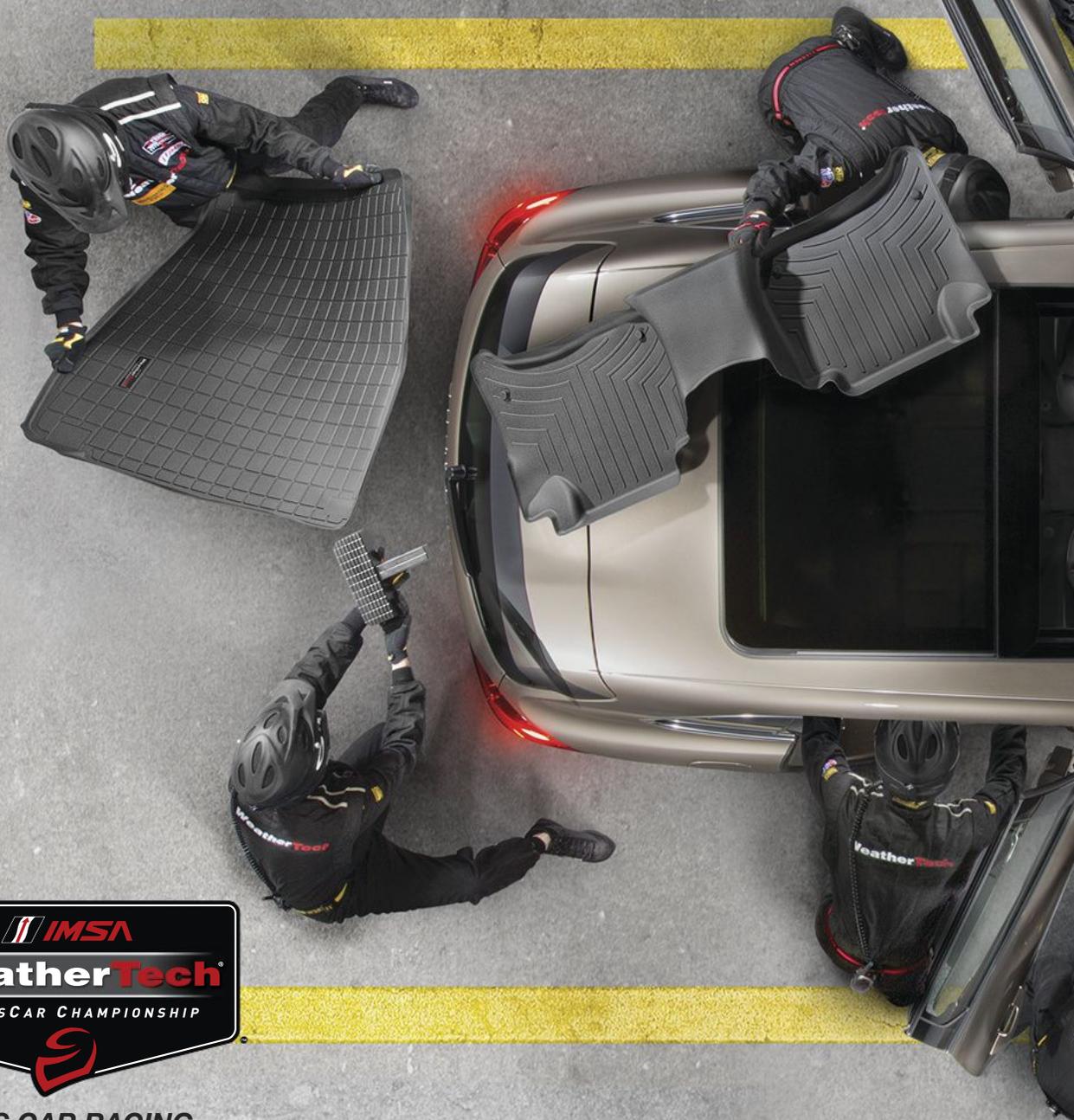


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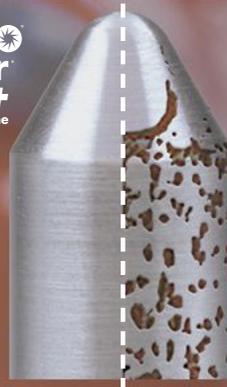


Intake valve deposit results based on ASTM D6201

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gasoline



Corrosion results obtained by using ASTM D7548/D665

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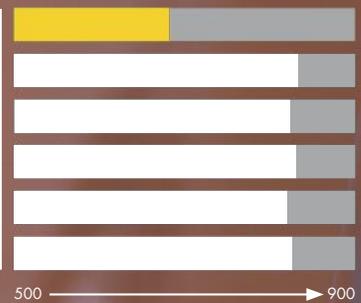
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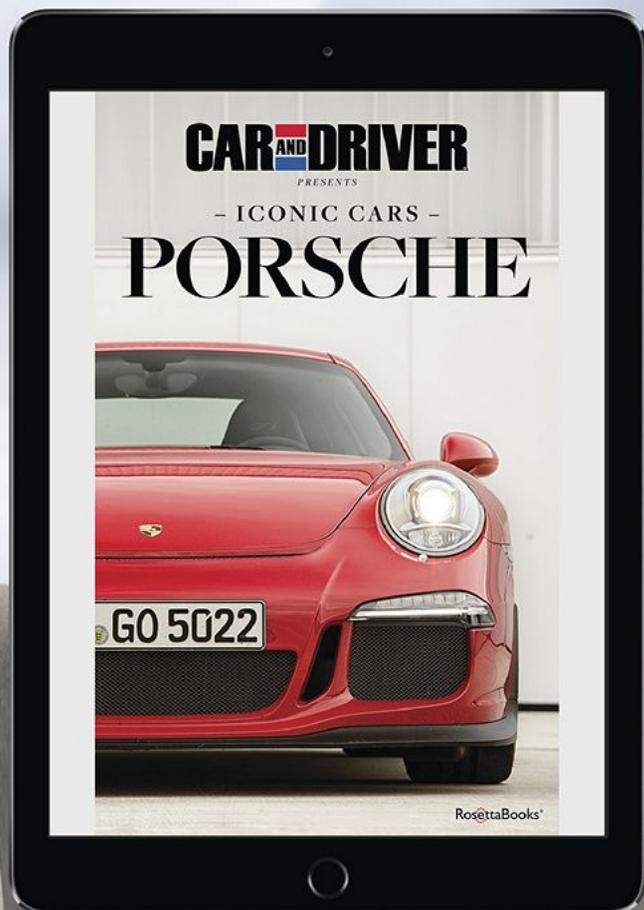
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2017 ALFA ROMEO GIULIA

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by *Mike Duff*

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JUNIOR ACHIEVEMENT

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by *Jeff Sabatini*

On the Cover

The Alfa Romeo Giulia
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its arrival.

photography by
Roy Ritchie

Car and Driver. vol. 62, no. 2

In this Issue:

“We ambled north to the Blue Ridge Mountains where we gave the tires a comprehensive exfoliation on the region’s sublime mountain roads.”

—DANIEL PUND, “JUNIOR ACHIEVEMENT”

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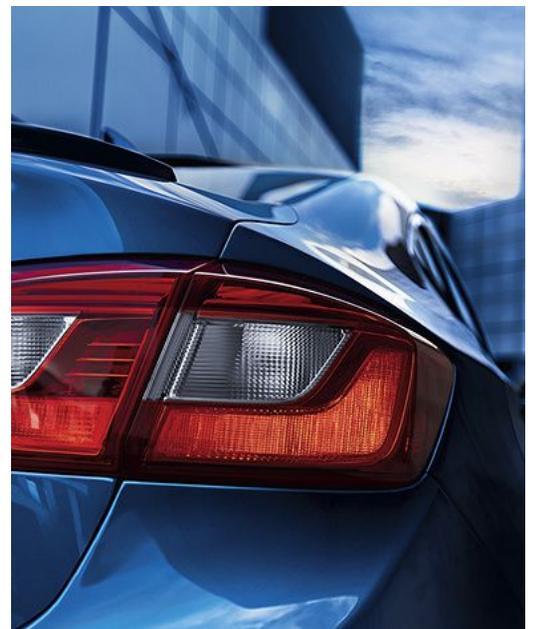
THE STORY OF THE ALL-NEW
2016 CRUZE

STRAIGHT FROM THE PEOPLE WHO MADE IT THE MOST
CONNECTED CAR ON THE ROAD!

How do you seamlessly bring a fully connected digital world into a vehicle while creating a simple, intuitive user experience? We sat down with two of the key Chevrolet minds behind the all-new 2016 Chevrolet Cruze to find out how they managed to get so much technology and efficiency into one very sporty ride.



Premier model shown. EPA-estimated 40 MPG highway with 1.4L 4-cylinder engine and automatic transmission.





PHIL ABRAM

EXECUTIVE DIRECTOR, CONNECTIVITY
AND INFOTAINMENT, CHEVROLET

What was the inspiration that drove the infotainment advancements in the 2016 Cruze and how has it provided a more intuitive driving experience?

Our customers live in a connected digital world, and they expect to be connected everywhere they go. Chevrolet is an industry leader in connected vehicles and GM has been an industry leader in automotive connectivity for 20 years with its award-winning OnStar® service. When we developed Cruze, we gave it available built-in 4G LTE Wi-Fi¹,² Apple CarPlay™ and Android Auto™ compatibility³ and a customizable Chevrolet MyLink⁴ system that allows the driver to be connected to the world from inside their vehicle via a central, easy-to-use touch-screen. We continue to explore new technologies and develop the latest digital systems that are richly capable and intuitive. For those customers who want to have their digital life brought into their car and their car connected to their digital life, the 2016 Cruze accomplishes this in a way that is truly unique in the marketplace.

What has your team been doing to make all this digital connectivity simpler to use?

We enable a variety of different ways to interact with the vehicle's infotainment system so customers are comfortable interacting with the technology in a way that comes natural to them. For some that means using available steering wheel controls and natural voice recognition. For others, they prefer a simple, clean and responsive touch-screen. Apple CarPlay™ and Android Auto™ compatibility are excellent examples of this, which come standard with the Chevrolet Cruze.

To help guide our overall connectivity approach, we've created Driver Workload labs at our test facilities. These labs complete in-depth studies on how people interact with these connected digital systems and provide feedback. All of this research, thinking and practical application comes together in the digital connectivity available in the all-new 2016 Chevrolet Cruze.

“Chevrolet is an industry leader in connected vehicles.”

Phil Abram

EXECUTIVE DIRECTOR, CONNECTIVITY AND INFOTAINMENT, CHEVROLET



JIM DIMOND

PROGRAM ENGINEERING MANAGER, CHEVROLET

What were some of the opportunities in working with a “blank slate” on the all-new Cruze?

We wanted to keep the new Cruze affordable and have it offer impressive gas mileage, but we were also determined to make it even more fun to drive. It's the best-selling Chevrolet car globally⁵ for a reason, and we wanted to amplify the features that make it so popular, like nimble handling and efficiency. So we made the body, the engine and the transmission lighter than the previous generation. Overall, we eliminated 250 lbs. from the vehicle and achieved greater aerodynamics, with a drag coefficient of only .28. The all-new ECOTEC® 1.4L turbocharged engine paired with improved transmission gear ratios helped us offer better mileage. And we were able to offer up to an EPA-estimated 42 MPG highway⁶ with a more agile and fun-to-drive experience. Our drivers appreciate efficiency, but they also enjoy a little hustle, and the all-new Cruze offers both in one very sporty package.

How did your global engineering and design teams work together to create the all-new Cruze?

The 2016 Cruze is available in more countries than any other Chevrolet vehicle.⁵ Our global teams shared ideas and learning from other projects and all of that experience went into creating the 2016 Cruze. We brought together insights from engineers who were making improvements to other vehicles, and best practices from different countries and manufacturing facilities. For example, we had engineers who developed the outstanding Volt aerodynamics working with Cruze engineers and designers to meet the stringent aerodynamic goals we set for the new Cruze. The results exceeded the goals. Production engineers at the different Cruze plants around the world have been able to share improvements they have made in the manufacturing process. There were a lot of late-night conference calls and hundreds of hours spent together in the wind tunnel. Creating the new Cruze has truly been a global team project that created a truly great car.



¹ Based on standard built-in 4G LTE Wi-Fi capability. ² Requires a compatible mobile device, active OnStar service and data plan. ³ 4G LTE service available in select markets. Visit onstar.com for coverage map, details and system limitations. Data services provided by AT&T. ⁴ MyLink user interfaces are products of Apple and Google and their terms and privacy statements apply. Requires compatible smartphone and data plan rates apply. ⁵ MyLink functionality varies by model. Full functionality requires compatible Bluetooth and smartphone, and USB connectivity for some devices. MyLink on Cruze does not include CD player. ⁶ Based on global Chevrolet sales and international market distribution for Q1 2016. ⁶ EPA-estimated MPG highway for Cruze LS/LT with 1.4L 4-cylinder engine and 6-speed automatic transmission.



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— Barkenmar

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Backfires:

I have received no more than one or two letters in my life that were worth the postage.

—Henry David Thoreau

STILL WAITING

Better recheck your specs! The 2017 Chevy Camaro ZL1 will sport a 10-speed automatic, not the eight-speed!

—Thomas Peterson
Bay City, MI

You got us, Peterson, our intel was short two speeds—Ed.

I bet you guys are feeling pretty foolish after picking a Camaro as the top car worth waiting for, when, in less than a week, more than 300,000 people put a grand down to be on the waiting list for the Tesla Model 3.

—François deVilliers
San Jose, CA

In your preview of the 2017 ZL1, I don't agree that the Ford Mustang Shelby GT350 and R models are the ZL1's competition since they're naturally aspirated. I think the 2015 Z/28 is the closer competitor. What do you think?

—Dave Harris
Northbrook, IL

When the next Z/28 arrives we'll add it to the list of GT350 competitors—Ed.

Loved all the new cars coming to market. James Hunt hasn't aged a day. What's his secret?

—Vic Oberhaus
Liberty Center, OH
Reincarnation—Ed.

The Porsche 911 R made me very sad. It showed me that Porsche, in fact, has a six-speed manual that would readily fit and work with the GT3's powertrain. It blows my mind that a car company that will sell me carbon-ceramic brakes for \$9000 won't charge me \$6000 for a six-speed manual. I just don't get it. Car companies used to give you a manual in the base price and charge you extra for an automatic. Now they should do the opposite, especially if there is one sitting around that they can gouge me for that is already developed and paid for!

—Payman
Khodabandehloo
Harvard, MA



“IT BLOWS MY MIND THAT A CAR COMPANY THAT WILL SELL ME CARBON-CERAMIC BRAKES FOR \$9000 WON'T CHARGE ME \$6000 FOR A SIX-SPEED MANUAL.”

You missed what has actually gone wrong with the 2016 Porsche 911 R. Porsche has painted itself into a corner by allocating the 300 or so cars slated for the U.S. to its VIP customers. There will be no normal allocation to the dealer network. Even if a person could write the check, only glee-club members can get one. It will be interesting to see how soon the first VIP car surfaces on the secondary market and at what sticker-plus price. Rest assured, as a true purist, if I received an allocation it would be a keeper.

—Scott C. Kerr
Butler, PA

Do you guys think you could use a little more contrast in the color

for the wording in your photo captions? I thought it was bad before, but then I tried to read the caption on page 52 of your May issue about the 2017 Lincoln Continental and couldn't even see half of it due to it being beige lettering on an off-white background. Please try to use contrasting colors whenever possible. I've been a subscriber since the '70s, but I'll have to look elsewhere if the words don't get easier to see. Thanks.

—Ed Kemmerer
Novi, MI

While reading through the 25 Cars Worth Waiting For section of the May issue—which only had about five cars worth waiting for and none that I can remotely afford—I

was disappointed to read the sidebar about Lamborghini deciding to not make the Asterion. That car was bloody gorgeous! Screw the expensive, complicated hybrid powertrain—just drop a turbo six or eight in there and make an entry-level car, à la McLaren 570S.

—Prescott Thompson
Albuquerque, NM

The designers at Kia really had to dig deep to pull off an actually quite nice rip-off of my teenage favorite exotic, the Lamborghini Espada, with the 2019 Kia GT.

—Rob Friedman
Denver, CO

Robinson, please stop pretending to be a reader—Ed.

I am only buying the Apple iCar if it runs on apricots.

—C. Benjamin Whalen
Kirkland, WA

Just get something now! Waiting around for a VW Tiguan is worse than *Waiting for Godot*. At least with *Godot* one just waits, he never actually shows up. With the Tighoweverthell-yousayit, I'd be looking at its sorry ass in my driveway every morning.

—Dave T.
Chico, CA

On page 72 of the May 2016 issue, the United States flag is hung incorrectly. The union (the blue part) should always be at the upper-left corner.

—Eldridge Cook
Birmingham, AL

Really? You can't display the flag of the

Letter of the Month:

Regarding your May 25 Cars Worth Waiting For section, you have raised the bar on snark: “Bavarian school bus,” “aluminum could be linked to infertility,” “Prismatic cylinder bores,” “sit five feet in the air while having their midlife crises,” “Yay to profits,” “hamster-piloted Soul,” “So Very Randy,” “priapic SVR,” “Pfft,” and this gem: “the scarf wearers who form the core of Apple’s fan base.”

—M.H. Reed
Danville, CA



United States properly? Blue field always to the left! Sad.

—Lowell Marx,
LTC OD U.S. Army, Ret.
Pataskala, OH

I wish I could walk through those waiting rooms and look closer at the details. I'll bet there are some skillfully chosen gems.

—Paul Davis
Grants Pass, OR

Just the improperly hung American flag—Ed.

AROUND THE WORLD IN A DAY

I'm glad *Car and Driver* is an automotive magazine and not a food publication. Who goes to France and eats at McDonald's ["French Bulldogs," May 2016]? Only idiots. Obviously, Mike Duff and his travel companions know nothing about food and drink. David E. Davis Jr. must be rolling over in his grave. I'll bet he would have fired Duff and company for eating pizza and dining at McDonald's while in France. Next time send someone who would actually appreciate the opportunity to see France and not be

stereotypical ugly Americans.

—Tom Guilfoyle
Ambler, PA

Not so fast, Guilfoyle. David E. once wrote, “For me, the Egg McMuffin hangs right in there with the works of Kettering, Edison, and the Wright brothers”—Ed.

Your hot-hatches article was fun with the exception of your including nearly every French stereotype I've ever encountered. In my experience there is little or no truth to the stereotypes, and most of the people I've heard express them have never been to France.

—Stuart Nordheimer
New York, NY

Duff reveals his state of maturity and the editorial staff of *C/D* reveals its capability for leadership in the sidebar, “The Haute and the Hatch,” on page 43. It is a sorry statement for all concerned. When Duff says: “English, motherfcker! Do you speak it?!” as a guest in another country, it tells me all I need to know about his credibility, judgment, and maturity, and it makes me question why I should trust anything he has to say. And by seeing it in your magazine, after passing editorial

review, it beggars the question of how much I can rely on the rest of what I read therein. I have been subscribing to and reading *C/D* since the 1960s, but the future is in doubt.

—Michael E. McGinley
Washougal, WA

Not a Pulp Fiction fan, eh?—Ed.

Having read the recent comparison of the Volkswagen Golf R, Subaru WRX STI, and Ford Focus RS, I am convinced that the tricks Porsche uses to ensure favorable reviews (preferred lists of journalists, etc.) are now used by VW and have resulted in biased journalism. The much less sporty Golf R ranked practically as high as the Focus RS, a newer model with much more power. The excessive emphasis on comfort and fit and finish—odd for a car magazine—makes up for the poor performance and disguises favoritism for VW that goes beyond the numbers.

Please cancel my subscription. If I want to read VW ads, I'll go to its website for free.

—Nyall Engfield
San Diego, CA

“The interior feels low-rent in this company.” Give me a break. It's a Subaru. One doesn't buy a WRX STI to be part of

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the crowd. Or to impress your mate with a multitude of vexing buttons and gauges (Focus RS) that look like they were glued on top of the dash as an afterthought. And the guts of the Subie will ensure the highest resale value by far compared with the Focus RS and the Golf R over time. I'll take the Porsche sound that resonates from the STI's boxer engine any day over the piped-in sound from the RS's engine. One thing you got right is that Subaru will roll out another STI in the not-so-distant future that takes the bar up another notch.

—Doug Pendery
Loveland, OH

Should we tell him that the Subaru's engine expired before the end of the test?—Ed.

\$40K for a Ford Focus? Oh, wait, this must be the April Fools' edition of *Car and Driver*, right? Good one!

—Gary Neubauer
Medway, MA

GIRLS & BOYS

Jeff Sabatini's "Fast Times at [Redacted] High" in the May issue

was an excellent read on the worth of past decades' driver-training programs. Many intellectual minds proffered stats and documentation for his exposé. However, I laughed at this suggestion: "Some safety experts would like to see GDL provisions get even stricter, requiring longer periods of parent-supervised driving." Parent-supervised driving? Decades of two-wheeled traffic enforcement on the left coast have taught me that impetuous soccer moms and work-stressed Pop Warner dads are ill-suited to the nuances of safe defensive-driving education, lest "do as I say, not as I do" be included in their lesson plans. Expand the GDL system and keep it at the professional level.

—Dennis M. Brown
[Redacted], CA

The real reason why teens aren't getting licensed is because insurance costs too much. You also hinted at another cost, the cost of driving school itself. Economically, it isn't worth it for teens



"IT'S ALWAYS SO EMBARRASSING TO ADMIT HOW BADLY AMERICANS STINK AT DRIVING. PLEASE, PLEASE, PLEASE, IF THE CAR MAGS DON'T LOBBY TO CHANGE DRIVER'S ED. IN THIS COUNTRY, WHO CAN EVER SAVE US?"

to rush to drive a car anymore. I was fortunate that driving classes were done by one of the teachers at my school. It cost \$50. I didn't have a car, either. I just drove one of my parents' cars after they got home. I still took the bus to and from school. I didn't really need a license, but it was easy to get and didn't cost much. That isn't the case anymore.

—Mike Oostdik
Milton, WI

My friends come here from Europe and always ask me: "Is everyone *#@&ing with me? Are they doing this on purpose?" It's always so embarrassing to admit how badly Americans stink at driving. Please, please, please, if the car mags don't lobby to change driver's ed. in this country, who can ever save us?

—Andrew Byer
Fort Lauderdale, FL

DIAMONDS AND PEARLS

A million bucks on the sticker ["Ship of the Desert," May 2016] and Aston still couldn't figure out how to integrate a navigation screen? Even that tiny one popping up like a jack-in-the-box out of the dash?

—Mike Boelter
St. Louis, MO

SIGN O' THE TIMES

The 2017 Mercedes-Benz E300 drive story [Drivelines, May 2016] is a sad thing. In a 13-paragraph piece, the first mention of driving comes in paragraph 10—and leads Eric Tingwall to immediately change the subject to the car's AMG variants. Time to change the name to *Car and Rider*?

—Keith B. Muntyan
Boston, MA

SEXY DANCER

If the first example of the Lamborghini Centenario carries a

0 instead of a 1, as shown in your photo of its number plate (0 di 20), doesn't that mean that there will in fact be 21 of them produced rather than 20? Or will the last example stop at "19 di 20"? That would be kind of weird, even for one of the Italian manufacturers.

—Ben Chan
Calgary, AB

The first "one" is a prototype that won't be sold to the public, so it's not counted in the run of 20—Ed.

What, no pic of a smokin'-hot model with big hair and tight leather leaning on the rear wing of the Lambo Centenario? What happened to life in the whips-and-chains lane? Stiletto? Roses?

—Paul K. Miller
Centennial, CO

NEW POWER GENERATION

A few weeks ago, after reading an article about the Jaguar



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F-type, which mentions how the V-6 is essentially the V-8 minus two pistons, I hit the internet searching for more technical information on this engine pair, but to no avail. Then today I opened the May issue of *C/D* to the article "Block Party."

Needless to say, you guys have answered all my life's questions. Thank you.
—Max Alward
Shrewsbury, MA

Great little article on the Buick V-6, but it leaves me with one question: You stated the 3800 V-6 has been used in many GM cars from Chevy to Cadillac. Remind me which Cadillacs had the 3800.

—Martin Logan
St. Louis, MO

Cadillac's version, used in four 1980–82 models, had a longer stroke and was marketed as a 4.1-liter V-6—Ed.

CONTROVERSY

I am an avid enthusiast and always enjoy your magazine. One thing that's always been unclear to me in your acceleration testing is "Top Gear, 30–50 or 50–70

mph." None of my friends can shed any insight on this, either.

My theory: With a manual transmission, you are driving in top gear at 30 (or 50) mph and mash the accelerator, noting how long it takes to reach 50 (or 70). Would this indicate anything other than how tall the overdrive gearing is, or are you allowing the driver to downshift to a selected "passing" gear from that point and accelerate, giving the best scenario of time? If the vehicle is automatic, naturally it would kick down to a passing gear and would not be defining the term "top-gear acceleration." How can both manuals and automatics be placed into the same category? Could you please clarify this test procedure?

—Bru Schmidt
Toms River, NJ

We've got answers, Schmidt. Check out "Explained"—Ed.

MONEY DON'T MATTER 2 NIGHT

In the Drivelines section of the May 2016 issue, and within a span of only one page, your minions reviewed a Lambor-

"WOW, THAT NEW CIVIC TURBO REALLY HAULS ITS UGLY ASS DOWN THE ROAD."

—Andre Jausaud
Caldwell, ID



Explained: Top-Gear Acceleration

On cars with manual transmissions, we conduct our top-gear acceleration tests in the vehicle's highest gear, applying full throttle between the start and end speeds. We leave automatics in their standard drive position and cruise at 30 or 50 mph until the transmission settles into its highest gear for the test's starting speed. We then mat the accelerator, prompting the transmission to kick down for the quickest acceleration.

It's true that there's nothing to be gleaned from comparing automatics with manuals. The stick-shift test reveals how a car's gearing matches the torque curve of the engine and, with the rise of forced-induction engines, often exposes turbo lag. The automatic-gearbox procedure indicates transmission response and real-world passing performance. We conduct comparisons with the same type of transmission whenever possible, but we still perform these acceleration tests on the rare occasions when we can't avoid putting manual and automatic cars in the same story. In those situations, you will never see us draw conclusions based on the 30–50 and 50–70 figures. Unless O'Rourke's writing it—Ed.

ghini Aventador and a Honda Civic. I haven't experienced that degree of mind f*ck since the last Puscifer concert. Transitioning from a rabid, fire-breathing Lambo to a tin-can Honda is comparable to the difference between a July 4th hot-tub orgy with the Dallas Cowboys cheerleaders and the visceral, everyman satisfaction inherent to successfully unclogging the toilet. Keep up the good work, you evil, dirty, godd*mned rat bastards.

—Col. F.
Somewhere, MI

WHEN DOVES CRY

Mr. Robinson, I enjoyed your piece about Nissan ["On the Perils of the PGC,"

May 2016]. I think it's emblematic of the industry as a whole. Some brands take their identity too seriously. Their family look can be too consistent.

Just the other day, my Mercedes-Benz S550 refused to unlock from a short distance away. As I approached closer, I thought perhaps the battery in my key had died. Lastly, standing four feet from the car, I noticed it was actually a C-class. I guess I could have saved \$70,000. Next time, I will.
—Nicholas Proia, M.D.
Canfield, OH

Nissan false starts? How about false stops? The (my) beloved Xterra has

been discontinued due to weak sales—10,672 units in 2015. Nissan must have made a killing on this SUV, but to hell with the customer. Maybe some investments, like Toyota did with the 4Runner (more than 97,000 units sold in 2015 alone), could get Nissan some sales?

—John Starich
Las Cruces, NM

Robinson's May 2016 column on the "pretty good car" was amazing. It describes the current car market correctly and clearly. We are at a turning point in car design, and Google and Apple are going to jump in. I was born in 2003 and got into car stuff in 2008. Since I



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got my first *Consumer Reports* in 2010, I have noticed how cars have gotten much worse, particularly BMWs. I think one thing is to blame: the crossover.

—Aaron Mansfield
Columbus, OH

Pertaining to Robinson's "On the Perils of the PGC" in the May 2016 issue: "Buying a new crossover is getting to be like picking out your favorite from Michigan's 68 trumpeters?" By that he must be implying that they get the job done, but are boring, bland, and thoroughly mediocre in the process. I guess by comparison, picking out your favorite from Ohio State's marching band is like buying a sports car! Go Buckeyes!

—Jason Lysinger
Columbus, OH

I WOULD DYER 4 YOU

You could put a Yugo on the cover and have a magazine full of golf-cart reviews and I'd still buy the issue just to read Ezra Dyer's awesomeness ["All the Rage," May 2016].

—Lucas Burke
Warrington, PA

Here's a New York City story to share. I was pulling out of the Javits Center on 34th—one of the few two-way streets in NYC. My wife called from a few blocks away and asked me to pick her up. No problem. I executed a swift U-turn from west to east. The street was clear. One

car just coming off the West Side Highway, but it was literally a few hundred yards away and going slowly. The guy saw me and started flashing his lights in an angry kind of way, so by the time he got to me at the light I was jacked and ready; my window was down as to invite confrontation even before he got there. Four guys were in the other vehicle.

The driver yelled: "Hey, you idiot, that was dangerous and illegal. You don't have the right to make a U-turn in traffic!"

I said: "Look around, pal, you're living in New York City. It's a true democracy here. If you need to learn how to live with it, that's your problem, not mine!"

All four guys stared at me in shock for a few seconds, took in the concept, and then burst out laughing. Hands came out the windows and across the divide to shake and agree on the terms of the settlement. Then we all moved on, smiles on our faces about the way you get to say it like it is here and, sometimes, be respected for it.

—Ian Jarvis
New York, NY

NOTHING COMPARES 2 U

Clearly, you guys need a Backfires section for Michigan respondents only. I think I know Larry Ritzke [Backfires, May 2016], too. He's a jackass.

—Dan Jakel
Grand Rapids, MI

I COULD NEVER TAKE THE PLACE OF YOUR MAN

My driving enjoyment often has been enhanced by listening to the music of David Bowie. Nice touch to link some of his song titles to select letters in the May 2016 edition.

—Richard Kulesza
Detroit, MI

Nice to see that Ed. is a Bowie fan, too. Almost makes him seem human. Long live the Thin White Duke.

—Matthew Simon
South Norfolk, VA

I loved the Bowie references in your Backfires column. Your with-it-ness makes me want to stay on your subscribers list.

—Dave Dill
San Francisco, CA

Longtime subscriber. I have never had any desire to write to a magazine, but after reading your May 2016 edition I simply had no choice. As someone who personally felt a deep sense of loss at David Bowie's death, I'm writing to thank the person responsible for the subtle tribute to an artist who can only be described as an iconic genius. To say the unexpected gesture moved me does not give the effort justice. So clever, so unforeseen from a car magazine, so awesome! Thanks for many years of entertainment.

—Ron Grove
Santa Monica, CA



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1585 Eisenhower Place,
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Published by Hearst Communications, Inc.

Printed in the U.S.A.

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*Available summer 2016. Obey all traffic laws, always drive safely and wear your seat belt. Damage resulting from racing, competitive driving, track and/or airstrip use not covered by warranty. See your New Vehicle Limited Warranty and Owner's Manual for proper vehicle operation and complete warranty details. ©2016 Nissan North America, Inc. Nissan and GT-R logo are Nissan trademarks.

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Upfront

Reveal of the Month

GREEN HELL ON WHEELS

AN R ASCENDS TO THE TOP OF THE MERCEDES-AMG GT PILE.

by Jens Meiners

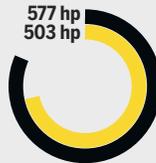


THE PATH TO LUNACY IS A SHORT ONE WHEN IT STARTS AT ABSURDITY.

■ AMG GT R ■ AMG GT S

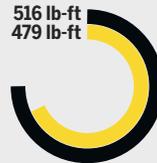
HORSEPOWER

577 hp
503 hp



TORQUE

516 lb-ft
479 lb-ft



001

■ **GERMAN DESIGN IS SUPPOSED** to be about restraint, about form following function. Bombastic flourishes and stylistic middle fingers are typically verboten; Mercedes-Benz design chief Gorden Wagener is fond of telling his staff to pull lines out of their designs. But with the AMG GT R, they went ahead and added a few, and you won't hear us complaining. The be-winged, be-splittered GT R exudes just the right amount of menace for AMG's new range topper.

▼ POWERTRAIN

Under that mile-long hood, the GT R sports a twin-turbo V-8 based on the one in lesser AMG GTs, but with a revised intake, new forged aluminum pistons, and a higher compression ratio. The output dial

001

The large horizontal slit between the taillights helps cool the center-mounted exhaust system.

gets turned up, from 503 horses to 577, and from 479 pound-feet of torque to 516. A lighter dual-mass flywheel is said to engender quicker responses and powertrain feel akin to that of a naturally aspirated engine. The titanium exhaust pipes move to the center of the rear fascia, and the aural experience should be every bit as forceful as the visual one.

The torque path to the rear wheels flows through a tweaked version of the "wet" sev-

GT R VS. GT-R

For an in-depth look at three of the GT R's primary competitors, see our comparison test starting on page 046. For a less exhaustive look at how the AMG's stats stack up against three other rivals, read on:



Mercedes-AMG GT R

Base Price: \$195,000* • Power: 577 hp
Torque: 516 lb-ft • 0 to 60 mph: 2.8 sec*



Acura NSX

Base Price: \$156,940 • Power: 573 hp
Torque: 476 lb-ft • 0 to 60 mph: 2.9 sec*



McLaren 570GT

Base Price: \$201,450 • Power: 562 hp
Torque: 443 lb-ft • 0 to 60 mph: 2.8 sec*



Nissan GT-R NISMO

Base Price: \$165,000* • Power: 600 hp
Torque: 481 lb-ft • 0 to 60 mph: 2.9 sec*

*Estimated



▲ THE GT R'S INTERIOR, CLAD IN LEATHER AND SUEDE WITH CARBON-FIBER TRIM, YELLOW STITCHING, AND YELLOW SEATBELTS, COMPLEMENTS ITS EXTRAVAGANT EXTERIOR.

en-speed automatic fitted to the GT S. Nine settings for the stability-control system allow the driver to tailor the amount of acceptable wheelslip precisely to his or her desire and talent (which, granted, are not always equal).

▼ CHASSIS

This latest addition to the AMG GT family has a significantly wider stance than its brethren. Its flared-out fenders (carbon fiber up front) enshroud wheel tracks that are 1.8 inches wider up front and 2.2 inches more bodacious in back. Its Michelin Pilot Sport Cup 2 rubber measures 275/35ZR-19 in the nose and 325/30ZR-20 aft and should stick to pavement like hot Tootsie Rolls. The carbon-ceramic braking system tucked behind those 10-spoke wheels is





standard, as are the gold calipers. The GT R shares its electronically controlled limited-slip differential with the GT S, but the rear-wheel steering system is the R's alone—so far. Two electric motors adjust the toe angle of the rear wheels, and we expect this setup will greatly enhance the high-speed stability of a car that we've found to be a little darty.

Despite its added content, the GT R is lighter than the GT S. Much of the weight-saving work is concealed, but the



002

That grille is the same as you'll find on the GT3 race car, and, like the GT3, the GT R should blaze around a track. The GT S logged 2:51 (min:sec) in 2015 at Virginia International Raceway for our annual Lightning Lap. That makes it 15th fastest of the 180 cars we've timed so far. We can't wait to see what the R will do.

003

The GT R's exclusive color is called Green Hell Magno in honor of Jackie Stewart's nickname for the Nürburgring.

003



carbon-fiber roof panel is tough to miss. The R's carbon-fiber torque tube is some 40 percent lighter than the S's aluminum unit, and a cross-shaped carbon-fiber underbody brace subs in for the trio of aluminum elements that serves the GT S, shaving mass and adding stiffness.

▼ AERODYNAMICS

AMG tweaked the GT's aero package in a big way, with active elements adjusting the R's aerodynamic profile according to speed. The coolest feature is the almost (but not quite) invisible carbon-fiber front splitter that reduces the narrow gap between chin and ground by 1.6 inches, creating a venturi effect that sucks the GT R to the asphalt. The front fascia's outer vents lower the drag coefficient by generating "air curtains" around the front wheels, and—when not needed to cool the engine or brakes—the large vents partially close to reduce drag. Around the back, a sizable diffuser and a manually adjustable wing battle for the gazes of onlookers.

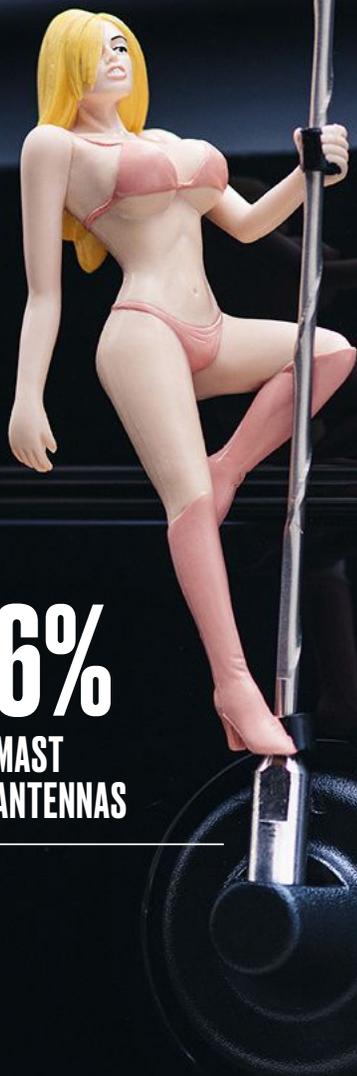
The so-called Panamericana grille, wider at the bottom and dominated by 15 vertical slats, was inspired by the racing 300SLs from the early '50s and comes straight from the GT3 race car. This is AMG's new/old *rennsport* (racing) face, a milder variation of which adorns the updated SL roadster. Get used to it, because it will migrate to other AMG models in the future.

This rawest and most provocative AMG GT goes on sale next summer. Mercedes isn't talking pricing yet, but expect a base approaching \$200,000. Despite its hardcore mien, the GT R will not be a limited-production run; Mercedes will build as many as it can sell. Regardless, if you want yours anytime soon, get in line now.

STRIPPER POLL

SCANNING THE MARKET FOR BASIC EQUIPMENT. *by Benjamin Preston*

IF YOU'RE OLD ENOUGH, you'll remember a time when the cheapest cars on the market could be purchased devoid of options. Scarlet letters of shame were assigned to four-wheel drum brakes, hubcaps on steel wheels, and a big delete plate over where the big-shot edition's air-conditioning controls would be. Times have changed, and so has the list of basic options. Wide-ranging consumer demand for gadgets and amenities has helped amortize their costs, such that on many models, it's simply not worth it for the automaker to design and manufacture, say, a door panel with space for both a hand crank and power-window mechanisms. It's one case of the trickle-down theory actually working; we don't miss the days of cranking the window up with one hand while helping it with the other. Here, we've calculated the small share of stripper hallmarks installed in new passenger cars for sale in the U.S.:



5%
REAR DRUM BRAKES
The Toyota Prius c is the only hybrid to offer drum brakes out back.

4%
MANUAL LOCKS

5%
MANUAL MIRRORS

6%
MANUAL WINDOWS

16%
HUBCAPS/WHEEL COVERS

1%
NO AIR CONDITIONING
With the exception of

high-end sports cars that offer to delete the A/C as masochistic peacockery, the Nissan Frontier and the Jeep Wrangler, Wrangler Unlimited, Renegade, and Patriot are the only passenger vehicles offered without air conditioning. Makes sense; nobody off-roads in warm climates, right?

2%
SINGLE-FLASH TURN SIGNALS
You'd think that once automakers adopted the triple-flash turn signal, in which the signal repeats three times when you just dab the stalk, the innovation would be complete. But if you put any full-size, body-

on-frame GM SUV or pickup into tow/haul mode and tap the turn-signal lever, you'll get six flashes. It's a thoughtful acknowledgment of the deliberate driving required when hauling a load.

1%
FIXED STEERING COLUMN
All the vehicles with fixed steering columns are two-box vehicles: a few vans and the Smart Fortwo.

6%
MAST ANTENNAS

SHOTGUN WEDDING

Among the rarest of options at the expensive end of the market is a gun case offered by Land Rover. Just 30 will come to the U.S. this year. It's more than just the case, actually, as the Holland & Holland Range Rover, named for the famed London gunmaker, is a full trim level. For \$245,495, its interior is laminated with walnut veneers sourced from the same trees as the guns' stocks, and scrollwork on the interior metalwork mimics that on the guns as well. The gun case itself is removable, lockable, and leather clad, but even at this price, it's empty. Stocking it with a new pair of Holland & Hollands will set buyers back at least another \$140,000.

HIGHWAY STAR

We didn't mean to have this thing, but a box arrived at our office from Korrupt Kittens years ago containing licensed likenesses of adult star Jenna Jameson, with and without buttock tattoo.

ROLL TAPE
LEXUS'S 2010 SC430 HAD AN UNLIKELY CLAIM TO FAME. IT WAS THE LAST CAR SOLD IN THE U.S. WITH A TAPE DECK. NOW THE QUESTION BECOMES: HOW MUCH LONGER DOES THE CD PLAYER HAVE LEFT?

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CLUTCH PLAYER

AN MIT FELLOW DEVELOPS NEXT-GEN TRANSMISSION TECH. *by Josh Jacquot*

□ DESPITE OUR BEST EFFORTS, the clutch, that fantastic frictional fuse between engine and transmission that has served us so long, has a dim future. With the manual gearbox critically endangered and an industry-wide focus on efficiency, the smartest minds in engineering are now hellbent on excising energy-sapping friction discs, even those in dual-clutch automatics. Dan Dorsch, a Ph.D. candidate and National Science Foundation Graduate Research Fellow in the mechanical-engineering program at the Massachusetts Institute of Technology, is one of those minds. In April, he won the Lemelson-MIT “Drive it!” grad-student prize, awarded to the design demonstrating the best potential for societal benefit, economic success, and environmental impact.

Dorsch’s design is a hybrid-vehicle transmission that replaces the traditional clutch or torque converter with a dog gear, using interlocking teeth rather than friction to couple the engine to the gearbox. Dorsch’s design significantly reduces the size, weight, and friction losses of existing transmissions, but the overall concept is geared toward fast cars rather than economy hybrids. An unnamed “leading performance-car company” is currently developing a prototype that could end up in the most exotic hybrids.

The transmission mates the engine with two electric motors, the larger of which is sized to launch the car at the friction limit of the tires. The second electric motor’s job happens inside the transmission, where it spins the engine to perform rev matching during

MODEL CITIZEN

THIS WORKING MODEL ONLY SERVES TO ILLUSTRATE WHAT DORSCH’S GEARBOX CAN DO, NOT HOW IT WILL LOOK. THE FINISHED PRODUCT WILL DISCONNECT THE ENGINE WITH A TOOTHED DOG-GEAR COUPLING (NOT SHOWN, 001) AND SPEED-MATCH GEARS WITH THE SMALLER ELECTRIC MOTOR (002) WHILE THE PROPULSION MOTOR (003) DRIVES THE WHEELS (004).



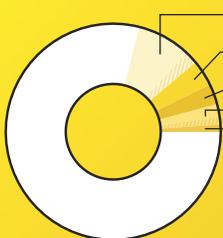
shifts. It also acts as a starter when driving the combustion engine and as a generator when the roles are reversed.

The larger electric motor moves the car off the line, filling the role of first and reverse gears and replacing the need for a clutch or torque converter to smoothly mesh a spinning engine and stationary wheels. As speed increases, the engine fires and the second electric motor joins the party. During gearchanges, the larger motor provides uninterrupted torque to the ground while the smaller one matches engine speed to that of the wheels—faster and more precisely than your feet ever could with declutching and throttle blipping. Dorsch says that with precise enough controls, friction cones on gear synchronizers could be eliminated, too, further streamlining the gearbox. The results, in theory, are perfectly speed-matched shifts, with no lurching and no need for the power-sapping clutches found in dual-clutch transmissions.

Should that unnamed manufacturer bring the transmission to production, it would make torquey all-electric launches fortified by zero-power-loss shifts a reality. We can’t think of a greater societal benefit.

JENNY KRIEG

Porsche’s PDK transmission is one of several available today that use all the components Dorsch’s design eliminates. In the 911, it weighs about 265 pounds. For a vehicle using Dorsch’s streamlined design, subtract key components as follows:



Clutches (depending on the model), 22–26 lb
Hydraulic fluid (for the dual-clutch control system), 10 lb
Starter motor, 8 lb
Lubricant, 5–7 lb
Reverse gear, 3 lb

All in, that’s between 48 and 54 pounds of hardware, or a tremendous 18 to 20 percent of a 911 tranny’s usual total.

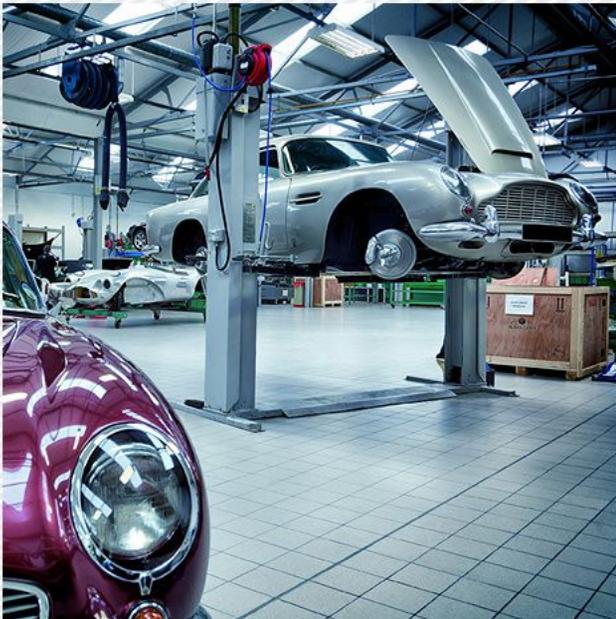


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Circa Circus

OLD MONEY

IF VINTAGE SPORTS CARS ARE CURRENCY, FACTORY-RESTORATION PROGRAMS ARE THE MINT. *by Clifford Atiyeh*

■ **CERTIFIED-USED-CAR PROGRAMS** are a bumping side business for most automakers, but they tend to trade in late-model vehicles. For seven luxury brands in the heart of a surging collector market, though, factory restoration and certification operations are now full-time divisions unifying formerly separate parts, service, and archival departments. Their advantage over independent shops? They'll recreate many parts from the original tooling—sometimes even with the original workers—and bless the car with a certificate that could add thousands or even millions to the price at auction time. Even though he runs one of those independent shops, Wayne Carini, longtime restorer and host of *Chasing Classic Cars*, sums up one possible appeal: “People buying cars now, they’re not car people. So who do they trust? It’s a stamp, a guarantee.”

001. ASTON MARTIN WORKS

YEAR FOUNDED: 1954

VEHICLES RESTORED: 400

SERVICES: Parts fabrication, 3-D scanning, certification, resales, road tests

RECENTLY SOLD: 1963 DB4 Series 5 Vantage convertible (\$1,484,019)

It takes 200 hours for a new \$290,475 Vanquish to come together on Aston's assembly line in Gaydon, England. But a car from Aston Martin Works, located at the old plant in nearby Newport Pagnell, requires nearly two years and is likely to cost even more. Or collectors can submit their car for certification under the Works's \$5800 four-tier process. Platinum cars are “absolutely perfect and original,” says com-

mercial director Paul Spires. Below that are gold, silver, and bronze certifications. For \$8800, Aston will perform a computer scan that can show irregularities in a car's body length, fit, and “under its shiny paintwork, a multitude of sins,” says Spires.

002. BMW CLASSIC CENTER

YEAR FOUNDED: 2010

VEHICLES RESTORED: 12 (est)

SERVICES: Certification, road tests, resales, rentals

RECENTLY SOLD: N/A, but figure between \$300,000 and \$700,000 for a restoration

Until 2010, BMW restored only the babies from its own private collection, many of which rotate through the company's

museum in Munich. Now, the *werkes* restores customer cars, maintains a stock of warrantied parts dating back to the 1955 Isetta, and issues certificates of authenticity. The latter are available for motorcycles and cars and involve a road test and inspection down to the details, such as the originality of a car's window glazing. If you're not in Munich, BMW will fly a tech to you and complete the \$67 certificate (the entire process is far more expensive). Can't drop a million on a refurbished 507? BMW Classic allows you to rent one of 400 cars and 170 motorcycles from the company's 100-year history, radial aircraft engines not included.

003. FERRARI CLASSICHE

YEAR FOUNDED: 2006

VEHICLES RESTORED: 90

SERVICES: Parts fabrication, 3-D scanning, certification with accompanying red book

RECENTLY SOLD: 250GTO (\$500,000, the approximate cost of the restoration to the customer)

Just as it takes prayer, hope, and a waiting list to buy a new one, having a classic Ferrari recognized by the factory requires patience. All race cars and road cars at least 20 years old are eligible. The \$560 application begins at your dealer, who details every identification number, takes photos, and submits the findings to Ferrari, which may require you to ship your car to Maranello, Italy. There, Enzo's last surviving son, Piero Ferrari, works with a small committee to personally review the results. After up to six months and \$5700, your certified Ferrari carries its own hardbound red book that's only one or two notches down from the Pope's Bible. Restorations usually land between \$100,000 and \$500,000. Ferrari



will do a full metallurgic analysis of the chassis, take 3-D scans, match modern water-based paint to the original hue, and replace leather stitching that isn't quite right.

004. JAGUAR LAND ROVER CLASSIC

YEAR FOUNDED: 2016

VEHICLES RESTORED: 8

SERVICES: Parts fabrication, tooling fabrication, new builds

RECENTLY SOLD: Land Rover Series I (\$88,000–\$117,000), Lightweight Jaguar E-type (\$1.4 million and up)

Over the past year, Land Rover quietly scooped up 25 copies of its original Series I and began restoring them at the Defender plant in Solihull, England. All 25 have been sold, and Series II and III trucks will be next, alongside customer-ordered restorations. “We’re talking to parts suppliers about lifetime supplies,” says Tony O’Keeffe, who ran the Jaguar Daimler Heritage Trust for 19 years before leading PR for Jaguar Land Rover Classic. In addition to six-figure restorations and building all-new lightweight E-type race cars from scratch—the next such project is a series of nine XKSSs—the division also made a rubber windshield weather seal for a guy who just wants his 2003 XK8 to run forever. He might also want to spring for a four- or eight-hour “health check” at \$147 per hour. For \$65 more, the factory will trace a car’s history and furnish a historical certificate.

005. LAMBORGHINI POLOSTORICO

YEAR FOUNDED: 2015

VEHICLES RESTORED: 2

SERVICES: Parts fabrication, certification, hiring former Lambo workers to beat metal like the old days

RECENTLY SOLD: 1971 Miura P400 SV (\$335,000, the approximate cost of the restoration to the customer)

Lamborghini’s PoloStorico team certainly made a grand entrance. The group took the first Miura SV prototype, revealed at the 1971 Geneva auto show, and brought it back to glory for this year’s Amelia Island concours, even preserving a botched hood badge that the factory had let slip past. Lamborghini has about \$56 million worth of parts inventory, with thousands of technical drawings and build specs. It’ll leverage them should you order the \$1100 historical certificate, which details a car’s factory configuration, or a complete \$6700 inspection that tears into the car’s guts to verify original parts. Full restorations start around \$200,000. Currently, Sant’Agata has four Miuras, two Countach Quattrovalvole, an LM002, and a 350GT getting such holy service.

006. MERCEDES-BENZ CLASSIC CENTER

YEAR FOUNDED: 2006

VEHICLES RESTORED: 29

SERVICES: Parts fabrication, resales

RECENTLY SOLD: 1971 280SL (\$275,000)

The Mercedes-Benz Classic Center in Irvine, California, could very well have sprouted from the soil, what with the Golden State’s natural penchant for SL roadsters and other Benzes. At this moment, there are more than a dozen 300SLs in the shop, where 22 employees do most of the metal, paint, and assembly work (a few outside



machinists help, too). Only one or two full restorations are completed each year.

In Germany, where Mercedes has its main Classic Center, the brand sells all manner of fully restored cars, including prewar models. Mercedes is happy to service cars from its 50,000-part inventory or build new parts if needed. The 280SL is a particular favorite, many of which rack up six-figure restoration bills after having done nothing but sit in garages for years.

007. PORSCHE CLASSIC

YEAR FOUNDED: 2015

VEHICLES RESTORED: 30

SERVICES: Partial restorations, service, the most perfect oil in the world

RECENTLY SOLD: None yet

Porsche doesn’t certify or fully restore its air-cooled beauties—yet. Since opening last summer, the seven-man Classic team at Porsche’s Atlanta headquarters has been rebuilding engines, refurbishing interiors, and doing everything but paint and bodywork. For those last steps, it will ship your car to Stuttgart and squeeze it onto the new-car paint line, complete with original body jigs and tooling. But most American

Porschephiles are happy for a tour, a hearty lunch, and a reasonable \$155-per-hour labor rate. (For the Carrera GT, which almost always has to be partially disassembled, it’s \$179.) They also come for Jack Swint, a 46-year Porsche technician with more training hours than anyone else in the company. And they can leave with a cool souvenir: a retro can of oil specially formulated for their specific flat-six.

50,000

— One-upmanship also extends to vintage-parts caches. BMW, Lamborghini, and Porsche all claim at least 50,000 pieces.

In 2005, I wrote a true-crime book called *God Wants You To Roll*, the story of two California teens—Robert Gomez and James Nichols—who sold \$21 million worth of nonexistent cars to 4000 buyers. The cars typically

sold for \$1000 or \$2000, and some were quite spiffy—a Lamborghini and a couple of Porsches, as I recall. Well, “spiffy” if vehicular ghosts in the heated imaginations of two dead-end security guards are spiffy. They kept the con percolating for five years, then were busted and tried in Kansas City, Missouri. The trial lasted the better part of a month, until the boys both drew 20-plus years in prison. A more entertaining month I have never spent.

Of the two perps, Robert was the more flamboyant. I had lunch with him one day, and he conned a pack of cigarettes from the waitress. He once fielded a phone call from a California detective and, on the spot, began impersonating partner James Nichols, complete with his voice and speech patterns. He played poker with Larry Flynt at Flynt’s Hustler Casino. He once claimed I was his agent and that the two of us were hatching a huge movie deal. He lived in a condo where a scene from *Ferris Bueller’s Day Off* had been filmed. And at the time he was arrested in the Hustler Casino, he just happened to be carrying \$818,120. It could happen to any of us, right?

Even as he duckwalked off to prison, Robert swore he still had \$8.7 million of the loot, stashed prior to the trial. Federal agents told me that was probably correct, and they began searching. Robert alternately told me the money was “in off-shore

accounts,” “in Swiss accounts,” “buried in my mom’s backyard,” and “in safekeeping with the Sinaloa cartel in Mexico.” It was all pretty far-fetched, but so was Robert.

And so, 11 years after I last talked to Robert Gomez in a Kansas City jail, I received an anonymous email. In part, it read: “I know where Robert put away millions of dollars worth of diamonds and real estate throughout Latin America . . . I am willing to reveal where all of this is. Documents, official documentation, and proof of bank boxes.” No name was attached to the message.



That was on March 30. For the next 16 days, we swapped emails. Mr. Anonymous revealed he had “excepted [*sic*] Jesus Christ” and was “feeling guilty about assisting [Robert] in hiding assets.” He told me he lived in Costa Rica. He said Robert had swapped gold and diamonds for 40 real-estate parcels in Mexico and that he purchased 14 ice-cream shops that he placed in his aunt’s name. Hey, a man’s gotta eat.

I told him that seizing money and real estate from a foreign country would be harder than Chinese Yahtzee and that it would require the assistance and intervention of the feds. Mr. Anonymous didn’t care. He kept encouraging me with tidbits such as, “Robert buried almost six million dollars worth of gold on one of his family members’ ranch in Guanajuato.” And this:

“Robert has some very evil maniac-like friends and business partners. Those maniacs, Mr. Phillips, have long tentacles.” Throughout, he insisted that I say nothing to the cops.

Of course, it was my trial-lawyer father who often told his less savory clients, “If someone says to you, ‘Don’t tell the cops,’ waste no time in telling the cops.” So I began to fret, recalling all the witnesses who’d testified in Missouri who’d had “guilty knowledge” yet continued to aid and abet. Did I have guilty knowledge? I contacted Gary Marshall, a retired federal undercover agent, and Curt Bohling, the assistant U.S. attorney who originally prosecuted the case. To my relief, they urged me to keep communicating but to yell if Mr. Anon started spilling specific actionable details. So far, I wasn’t complicit. But it seemed as if waterboarding might lie in my future.

On the other hand, it struck me as surpassingly strange that the emailer claimed not to have had any contact with Robert for more than 10 years, yet he knew Robert’s inmate number and the location of the latest prison to have welcomed him. And then he added this telling pearl: “Rumors were going around that a large film studio in Mexico City had signed some type of a movie deal with Robert.”

Well, I’d heard a variation of that story before, and this whole emailing routine began issuing the fetid odor of fakery, with Robert as its probable epicenter. My next communication thus read: “Dear Robert: You told me to contact you, so I am.” Very clever on my part, I thought, wondering if some sort of federal commendation was coming my way. But, of course, “Robert” immediately denied that he was Robert and added, “Please stop wasting your time with me.”

At the gym, my friend Heidi advised, “Don’t call Sean Penn just yet.”

Which was terrific advice. So I told the Kansas City feds to stand down, and I emailed Mr. Anon one last time: “Remember Will Rogers’s credo: ‘Never miss a good chance to shut up.’” Then I contented myself by binge watching *True Detective*. ■

John Phillips

TEST 297
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Sometime in the latter 1970s, we reached peak carburetor. By that I mean the carburetor on the average family sedan, squeezed by the vise of new regulations, achieved its zenith in complexity and parts count.

Take the Rochester Quadrajets as an example, suggests my old friend Paul Wright, a Q-jet expert. Initially an elegant four-barrel design with smaller primaries for quicker part-throttle response and efficient cruising, and larger secondaries for ample wide-open roar, it was the mainstay of fuel metering on GM cars for more than a decade after its introduction in 1965.

But by 1975, control devices, pushrods, and cams were growing on it like boils. There were hot-idle compensators, timed canister purge ports, air-valve dashpots, aneroid metering rod assemblies, and thermostatic coils. Pressed by the safety crusaders and the EPA (established in 1970), GM even gave the Q-jet electronic controls, trying to make it cleaner when cold, more reliable when hot, safer in a rollover, and less stinky when doing nothing at all. As a result, a relatively simple and effective Bernoullian device for atomizing fuel at an appropriate ratio to the incoming air finished its days looking like a steam-powered candy striper. Baffled mechanics like to call it the “Quadrajunk.”

But even the best carburetor couldn't deliver the change society was demanding from the automobile, and the industry eventually switched to injection en masse. Briefly, the top of the engine became a simpler place as carbs gave way to fuel rails. However, massive triumphal success cut-

ting the local scourges of smog and soot has only given way to a new societal urgency to attack the global scourge of carbon dioxide. The only way to reduce CO₂ is to burn less fuel, so the engine is being pushed to increasingly tortured lengths to find efficiency. The question is, are we now reaching peak engine?



Recently I was sitting in a tech presentation for Porsche's new 991.2 generation of turbocharged 911 Carreras. The MA2, as Porsche calls the 3.0-liter twin-turbo flat-six that becomes the base engine in the 911, features a host of electromechanical widgets intended to save fuel, drip by drip. Electronic control of the oil pump reduces engine load when high pressure isn't needed. A two-stage water pump speeds the engine up to temperature for emissions and delivers only “need-based cooling” to reduce parasitic losses. A new polymer oil pan saves 4.4 pounds while being durable enough to survive the entire engine being dropped on it from a height of several feet (we saw the video). The assembled camshafts drive high-pressure pumps to deliver fuel to the injectors at up to 3625 psi and are the heart of a glorious temple of expensive, fine-tolerance machining.

Later I mentioned to the engineer giving the talk that compared with the zillion-part-number MA2 and its zillion-part-number PDK transmission, each with

its millions of lines of software code, an electric-vehicle motor and battery look as simple as a rope and pulley. Surely, simplicity alone is a significant inducement for automakers to invest in EV development? The engineer nodded, then talked about all the shops making engine bits around Weisach that could be facing hard times. In the post-Dieselgate VW Group, electricity is all anyone seems to be interested in. Porsche Cars North America's new CEO, Klaus Zellmer, confirmed as much that evening at dinner, when he dismissed the rumored 960, a quad-turbocharged flat-eight coupe, as something Porsche has studied but that is “irrelevant” given the group's focus on electric and hybrid technology.

EVs have issues, from range to weight to cost to consumer acceptance, and their ubiquity may be a decade or two off. But the internal-combustion engine seems to be in danger of collapsing under the weight of its own Gordian complexity. I asked my colleague K.C. Colwell if he could think of any recent examples of engine development gone bonkers. He quickly emailed back a list, including Volvo's turbo- and supercharged 2.0-liter four, Audi's triple-boosted 3.0-liter diesel V-6 with twin turbos and an electric supercharger, and Ford's 10R80 10-speed transmission for the F-150, which has a wide enough ratio spread to keep the engine revs below 1400 rpm in the EPA economy cycles. We've reported on dual-injection systems, water injection, several quad-turbo engines, and, from Volkswagen, a 1.5-liter four with an exotic variable-geometry turbo and cylinder deactivation, which means it runs as a two-cylinder because, you know, two is the new four and four is the new 12. More systems, more software, and more of the engine experience simulated through sound generators and robo controls.

Well, if this is indeed peak engine, don't be too downcast. It's been a good run, and tremendous simplification may be on its way. Yes, electric motors, whoopee, but then again, weren't you just complaining that cars are too dang complicated to work on anymore? ■

Aaron Robinson

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History is a commodity. Mercedes-Benz has been around since the breakup of Pangaea, and it doesn't let you forget it. Dodge references its founding brothers to imply that a scurrilous streak persists in its cars today (and it does).

Kia even wants you to know that it made bicycles back in the day. Give Tesla another two years and it'll be running those sappy ads where a child grows up and then grabs the keys while a weepy parent gazes down the driveway.

Car companies, stewards of their own mythology, often maintain vehicular collections to celebrate their greatest hits (and some even rebuild them; see "Old Money," page 030). But these cars tend to be either precious museum pieces or nice used cars sourced from private owners. And in the latter case, you never know which peccadilloes were factory and which were inflicted by a prior owner who might've done a donut in a Denny's parking lot in 2004 and thus subtly altered all future readings of the text. What you want, and really never find, is a car with enough mileage that you can drive it but not so much that it's lost the new-car magic. What you want is a 20-year-old Jaguar XJS



with a thousand miles on it. Which, conveniently enough, is something that Jaguar just so happens to own.

I found this out when I mentioned that I was heading to the Pinehurst concours, an upstart event that's beginning to attract some formidable machinery. A few weeks later, I was taxiing down a cart path behind the wheel of the nicest 1996 XJS in the country, if not the galaxy. This is the last XJS built for North America, a car that some visionary at grunge-era Jaguar had the foresight to salt away, back when it probably just seemed like a strange relic from the British Leyland days. Good call. Normally it takes 30 or 40 years for a once-cool car to circle back around to desirability, but this XJS has a 21-year head start. The car's registration may say 1996, but its groovy panache says 1975, the year of the original's (called XJ-S then) debut. This thing is all Zeppelin, no Spacehog.

With mere break-in miles on the odometer, this XJS has no excuses for any slop or shenanigans. And, somewhat to my surprise, it really doesn't have any. Sure, there's a bizarre pimple on the hood that had to be factory, and the action of the emergency brake lever is as pleasant as a high-five from Captain Hook, but the car is tight. Putting on my '90s car-reviewer hat (which is actually a mullet wig and a Big Johnson T-shirt), I'd note that the XJS and its 237-horsepower

aren't trying to play an SL500 game. I mean, there's an S/N button near the shift lever, but I never even pushed it. I assume it toggles the shift programming between Stately and Nonchalant.

The one time I held down the throttle all the way through first gear, the transmission upshifted at 4500 rpm. Older Jag straight-sixes blat out a rowdy chortle, but this one seems propelled by nuclear fission or perhaps some unseen system of cables buried in the road. It's an imperial glider, a catamaran sailing the Straits of Syrup. I hereby posit that no modern car rides any better than a 1996 XJS. It's that good.

And people love this car. When I pass one of my neighbors heading the opposite way, he peers at the Jag with an expression of exasperation at my good fortune. "I want to be you when I grow up," he says. That's definitely not a wise aspiration, but driving an XJS certainly is. There was a time when the XJS was just sort of a tragic machine, a 12-cylinder cauldron of despair, but it's turned the corner. That rakish acre of hood gets noticed in the right sort of way. Even at Pinehurst. Out on the fairway, the XJS attracted a steady parade of appreciative onlookers, which I know because I lurked nearby and monitored it like a total creep. Of course, the green droptop may have been getting some shine from the two cars parked next to it—a 2016 F-type R coupe and a 1994 XJ220—but I learned that the XJS can pull its share of photos. I also learned that you can't find tires for an XJ220 because the originals don't meet modern EU noise regulations. Ah, yes, Jaguar XJ220 tire noise: the scourge of Europe.

At the conclusion of the show, I surrendered the XJS, which got packed into a truck and sent back to Jag headquarters to resume its life of leisure. Then I got into my ride home: the F-type. It's a menacing car, supercharged and superloud, with carbon-ceramic brakes and a thorough lack of concern for nostalgia. Nothing about an F-type conjures up notions of tea or shrubberies. It's great that Jaguar has a history worth celebrating, but it's even better that Jag has learned how to ignore it. ■



▲ THE XJS CAN FINALLY TAKE ITS PLACE IN THE CLOUDS.

Ezra Dyer

NOT JUST A PRETTY HAIRSTYLE.

I CAN WIN
ANY CAR GAME
IN MANUAL OR
AUTOMATIC.

SPIKED-UP LOOK
STYLING PUTTY.



EXTREME HOLD.
LONG-LASTING.

AXE
FIND YOUR MAGIC.

IS THE WAIT FINALLY OVER?

**And 10 more
questions
we had to ask
before we
could possibly
take this thing
seriously.**

*by Mike Duff
+ photography by Roy Ritchie*



2017 Alfa Romeo Giulia

Alfa chose
Giulia (Julia,
in English)
because Karen
was taken.



1) What's taken so long?

The Giulia's gestation has been as complicated as the plot line of an Italian *telenovela*, with its development (or lack of it) happening in parallel with Alfa Romeo's ambition to return fully to the United States. It's been a decade since Sergio Marchionne, then Fiat's CEO, first promised to bring Alfa back, the merger with Chrysler in 2009 offering an obvious shortcut to making it happen. The original plan was for the Giulia to use the same Compact U.S. Wide platform that underpinned the Dodge Dart and Chrysler 200. Fortunately, that certain rendezvous with disaster was nixed, reportedly by Marchionne himself when he realized what a bad basis for an aspirational sports sedan the Dart would be.

Instead, Alfa developed a new rear-drive platform mostly by itself, the project in the hands of a small team known as the Skunks, in reference to Lockheed's famously beyond-top-secret Skunk Works operation. The production Giulia made its debut at the Frankfurt auto show last year and will reach the U.S. in 2017. The base version will be powered by a turbocharged four-cylinder engine, with the range-topping Quadrifoglio, or "Cloverleaf," using a 2.9-liter twin-turbo V-6 producing a BMW M3-belittling 505 horsepower.



2) Is it finished yet?

European sales start imminently, although we're still waiting for exact dates for the U.S. versions (all Giulias will be built in Italy at Fiat's Cassino plant). We have driven Euro-spec models at a launch event held both on and near Fiat Chrysler Automobiles's vast test track at Balocco in Italy. Much is impressive, but, to return to the original question of completion, we did find a surprising number of electrical idiosyncrasies in the cars we drove there, from freezing display screens to an unprompted engine-management light. We also found that the interior trim did little to debunk all those stereotypes about the quality of Italian manufacturing, with some cheap-feeling switchgear and a center console that deflected under gentle pressure.

Less distinctive than its front, the Giulia Quadrifoglio's rear at least looks as if it means business with its large aerodynamic diffuser and lip spoiler.



3) Who designed it?

Alfa styled the Giulia in-house, the team led by the brand's now-former design boss Marco Tencone, who has been replaced by former Dodge and SRT chief designer Scott Kruger. (Other departures from the senior team behind the Giulia include engineering boss Philippe Krief and—as we close for press—CEO Harald Wester. It's like the end of *The Godfather*, and seeming proof that Marchionne hasn't appreciated the delayed

launch.) The Giulia's face is pure Alfa, but from other angles it reveals more influences than a teenage funk-soul-reggae-fusion band, from the Kia Optima to the Infiniti Q50. In profile, it looks as if it's trying to be an Italian E46 BMW, even sporting a Hofmeister kink in its rear window.



Tencone also was chief designer of 2014's beautiful Maserati Alfieri concept.



4) Is it a real Alfa?

Yes, and the realest in many years. Although Alfa has managed to produce some truly special limited-run sports cars during its protracted malaise, it's been a long time since any of its volume models were anything other than thinly disguised Fiat Group platform clones. Alfa's last sedan, the 159, sat on a Fiat-GM platform of such mediocrity that GM refused to use it for any of its own models.

Giulia Sprint GTA



5) What's the Quadrifoglio like to drive?



Alfa would only let us try it on Balocco's handling course, with the straights broken up by temporary chicanes to make sure we didn't accidentally validate the claimed 191-mph top speed. Our time in the car was limited by the fact that more than 50 journalists were waiting to experience just four Quadrifoglii, which led to longer lines than those at the Mustang Ranch on two-for-one day. However, our elbows are the sharpest in the business, and we got to experience both manual and automatic versions of the Quadrifoglio, albeit briefly.

It's certainly not lacking in visual aggression. The basic Giulia looks a little timid for our tastes, but the Quadrifoglio gets a muscular reworking that includes an active front splitter under the bumper. It opens under braking or cornering to add a claimed 220 pounds of downforce and can work in concert with an equally serious-looking diffuser at the back. The Quad's curb weight is cut by a carbon-fiber hood, roof, and driveshaft, while all Giulias have aluminum fenders and doors. Alfa's claimed 3360-pound weight is without fluids; that still stands out compared with German rivals.

The manual gearbox delivers a purer driving experience than the automatic, but it's clear that less development effort has gone into making it work with the V-6 engine. The lever is well weighted, and it's fun to use quickly, but during gentler driving the heavily boosted engine suffers from noticeable low-rpm lag. Below 3000 rpm there's a distinct pause followed by a swelling sensation, the horses needing a couple of seconds to get up and gallop. The eight-speed automatic's ability to either drop a gear or to slip its torque converter helps spool up the turbos more quickly; all those horses pretty much drop through the ceiling at that point. Although the automatic's changes aren't as quick as a dual-clutch's might have

The lucky four-leaf clover first appeared on a racing Alfa in 1923.

been, they're still faster and less dramatic than the speediest you can do with the manual 'box.

It's impressively quick once the V-6 has reached full vibrato, and it pulls hard all the way to the limiter. Longitudinal g-loadings barely seem to diminish as speed builds, and the cars at Balocco were fitted with the optional carbon-ceramic brakes that proved to be equally adept at inverting those g's. The pedal lacked initial feel, but retardation was tireless, a fact made clear by the many chicanes Alfa dotted around the track.

Lateral g-forces are another matter. The

2017 ALFA ROMEO GIULIA

VEHICLE TYPE: front-engine, rear- or all-wheel-drive, 5-passenger, 4-door sedan

BASE PRICE (EST): \$40,000-\$65,000

ENGINES: turbocharged and intercooled SOHC 16-valve 2.0-liter inline-4, 276 hp, 295 lb-ft; twin-turbocharged and intercooled DOHC 24-valve 2.9-liter V-6, 505 hp, 443 lb-ft

TRANSMISSIONS: 6-speed manual, 8-speed automatic with manual shifting mode

DIMENSIONS

WHEELBASE: 111.0 in
LENGTH: 182.6-182.8 in
WIDTH: 73.2-73.7 in
HEIGHT: 56.1-57.1 in

CURB WEIGHT: 3400-3600 lb

PERFORMANCE (C/D EST)

ZERO TO 60 MPH: 4.1-5.6 sec

ZERO TO 100 MPH: 9.1-14.1 sec

1/4-MILE: 12.3-14.2 sec

TOP SPEED (MFR'S EST): 149-191 mph

FUEL ECONOMY (C/D EST)

COMBINED/CITY/HWY: 19-25/16-21/25-33 mpg



6) Does it really have 505 horsepower?

Most won't, but one does. The European-market powertrains we drove at Balocco have limited U.S. relevance. There was a 197-hp four-cylinder gasoline turbo and two 2.2-liter turbo-diesels, none of which are scheduled to come here. We've been told that the base U.S. spec will be a

brawnier 276-hp turbo-charged four. Fortunately, we didn't leave Balocco without driving the range-topping Quadrifoglio, which will definitely be heading stateside. It does indeed have a claimed 505 horsepower.

The official line is that this engine is "inspired by Ferrari technology and technical skills," which it is, being basically a six-cylinder sister to the

Ferrari-designed F154 turbocharged V-8 that powers the 488GTB, California T, and Maserati Quattroporte GTS. Peak power comes at 6500 rpm, with the limiter set at 7000 rpm. The V-6 drives the Quadrifoglio's rear wheels through either a six-speed manual or an eight-speed automatic gearbox and then a clever torque-biasing rear differential.



Quadrifoglio's chassis finds impressive grip and the fast-ratio steering works well on-track, but the stability-control system prefers to rule things. There are three switchable dynamic modes that, as in all Alfas, are named in honor of deoxyribonucleic acid as an esoteric reference to the brand's sporty DNA. Besides the dynamic, natural, and advanced-efficiency (a.k.a. eco) modes, there's a race mode. As you'd expect, dynamic mode sharpens throttle response and firms up the adjustable dampers, but it doesn't wind back the traction management, which can't be controlled separately. The mode still refuses to allow any rear-end slip. The stability sentinels work to reduce understeer and to maximize traction, but the result is a rear-driven car, with nearly as much power as two 4Cs, that refuses to take directional instruction from the throttle pedal.

The answer is to switch to race, which disables the whole stability system and quickly proves that the Quadrifoglio is ready, willing, and able to steer from the rear. It feels much friendlier at the limit than a BMW M3 or M4, starting to slide at lower speeds but doing so much more progressively. The quick-ratio steering works well to keep it pointed (mostly) in the intended direction. Call us fearful if you like, but we—and we suspect most owners—would appreciate a more permissive stability setting somewhere between “nanny knows best” and “may the Force be with you.”

The driver in the above photo has clearly activated race mode. It's the only setting in which the Giulia Quadrifoglio is allowed to hang its tail.



7) What about the standard car?

We were allowed to drive the basic Euro-spec Giulia on the road and can report that it seems to cope extremely well with the real world. Or, at least, rural Italy. Refinement is outstanding, the Giulia subjectively rivaling the Mercedes-Benz C-class in both noise and ride quality. A 100-mph cruise on the autostrada provoked a minimum of road and wind roar while the chassis shrugged off the roughest roads we could find. The high-g geared steering delivers keen responses, although there's little feel behind the power assistance. There's also less low-speed understeer than in the current BMW 3-series or Audi A4. Besides the not-for-U.S. diesels, we also experienced the European gasoline engine, which augurs well for the more powerful version that will make it here. Even with 197 horsepower, it pulls hard. In the manner of modern small-capacity turbo engines, though, it isn't keen on revving beyond 5500 rpm.





8) Does it sound good?

The Quadrifoglio sounds great—snarling, angry, and very Modenese. Nobody can make a V-6 with more aural appeal than the Italians. The four-cylinder gasoline engine also reveals an impressively hard-edged bark when being worked. The diesels sound like diesels, but that shouldn't matter to us.



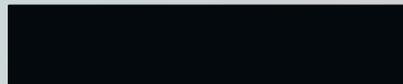
The Quadrifoglio's spindly wheels subtly recall Alfa's classic five-hole wheels. They cover optional Brembo-sourced carbon-ceramic brake rotors.

9) What else will be built on this platform?

Lots. Alfa's turnaround plan involves a total of eight new models, with all of them (except 4C variants) set to use some version of the Giulia's platform and to be either rear- or all-wheel drive. The next, driven by market demands, is likely to be a small crossover, followed by a rear-drive replacement for the current European Giulietta hatchback. It's also possible that the production version of Maserati's Alfieri coupe concept from 2014 will be spun from the same architecture.

10) Where will FCA sell them?

Alfa's lofty position within FCA has allowed the brand to expand its U.S. dealer presence, even with only the 4C to sell. There are already 139 dealers in the States, with the promise of more to come. Coverage in California and the Eastern Seaboard looks good, as it does around other large metropolitan areas. Beyond that, things get patchy, especially in the Northwest. Currently there isn't a franchise between Spokane and Minneapolis, although we're told the brand is planning to expand its network ahead of the start of Giulia sales.



The Giulia's interior design is stylish without seeming overwrought.



11) Does it have a shot against the BMW M3 and the Mercedes-AMG C63?

Yes, and a good one. The Quadrifoglio outguns all its obvious rivals by an impressive margin and, based on our limited first impression, delivers more emotional appeal than any of them. This is one comparison test that we're looking forward to. 🍀

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When you combine the sporty aspects of a coupe and the versatility of an SUV, you get a crossover that feels at home everywhere. The Infiniti QX50's 325-horsepower V6 engine provides 267 lb-ft of torque, giving you the power you want at a moment's notice.



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WITH PERFORMANCE TO RIVAL THE HYPERCAR
TITANS, THESE THREE JUNIOR SUPERCARS
PROVE THAT THE FUTURE IS IN GOOD HANDS.

_by Daniel Pund _photography by Marc Urbano



AUDI R8 V-10 PLUS

Price: \$202,750 • Power: 610 hp • Torque: 413 lb-ft
Weight: 3684 lb • 0–60 mph: 2.9 sec



▲
McLAREN 570S

Price: \$219,770 • Power: 562 hp • Torque: 443 lb-ft
Weight: 3189 lb • 0-60 mph: 2.9 sec

▲
PORSCHE 911 TURBO S

Price: \$192,735 • Power: 580 hp • Torque: 553 lb-ft
Weight: 3563 lb • 0-60 mph: 2.6 sec



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here is no acceptable way to begin a story about 500-plus-horsepower, \$200,000 sports cars and include in the first sentence a reference to that class of quasi-station-wagon family movers known as crossovers.

But hang on. As in the pseudo-off-roader market, sports cars now populate so many strata of the market that they require increasingly specific monikers and modifiers to sort them all out. Used to be, you had your sports cars and your regular cars. Then came the supercars, those increasingly outrageous-looking, typically mid-engined wedge- or arrow-shaped things. But why stop there? Why not create

something straight out of the world of aerospace and require that we add an even more breathless label? Thus was born the hypercar. And so, in between the everyman Mazda MX-5 Miata and the race-track-bound \$3 million Ferrari FXX K, carmakers have rushed to fill every price and performance gap in the fun-car market.

About three-quarters up the performance scale sits one of the most competitive sectors: the roughly \$200,000 class we're now referring to as "junior supercars." For that not-inconsiderable amount, a buyer can expect a dash, or more, of carbon fiber, 550 horsepower or more, an engine typically mounted behind the occupants, a zero-to-60-mph time of less than three seconds, a top speed just above 200 mph, and a dual-clutch automatic gearbox. And these little siblings to the Ferrari 488GTB and McLaren 650S represent a market bull's-eye in that they are within reach of the merely very rich but offer the crowd-wowing looks and perform-

ance close to the likes of Bugatti, the Ferrari LaFerrari, and the McLaren P1 for about a tenth of the price.

First in the fight is the second-generation Audi R8. Subtly redesigned and stripped of its optional manual transmission, the R8 is the sister car to the one-step-up Lamborghini Huracán, with which it shares much of its carbon-and-aluminum structure, all-wheel-drive system, and high-revving midships-mounted V-10. Our test car wears the Plus suffix, meaning its 5.2-liter V-10 pumps out 610 horsepower (70 more than the standard R8 V-10) and it's lashed with a hefty dose of carbon molecules, including a fixed carbon-fiber rear wing, various carbon accents, and carbon-ceramic brake rotors. At a base price of \$192,450 (including a \$1300 gas-guzzler tax), the R8 V-10 Plus represents a roughly \$40,000 cost savings compared with the Huracán LP610-4. Audi plumped our test vehicle's price to \$202,750 with the addition of an upgraded Bang & Olufsen audio system (\$1900), full-leather interior with contrasting stitching on the 18-way adjustable power seats (\$5000), and 20-inch wheels (\$1500), along with a couple other optional doodads.

The R8 may constitute a value compared with the Huracán, but Porsche's freshly tweaked 911 Turbo S undercuts the Audi's as-tested price by some \$10,000, thanks to its lower starting point and an option load that's unusually light by Porsche stand-

Invading NASCAR country in an alien trio of candy-colored supercars. Everyone knew what the Porsche was. Only one man recognized the Vector.

ards. The updates for this so-called 991.2 version of the Turbo S are mostly detail changes, although it carries an additional 20 horsepower versus the last Turbo S, thanks to larger turbo-charger impellers and reworked intake ports. The 911 Turbo S represents a dif-





ferent approach to the \$200,000 sports-car conundrum, in that it's the highest expression of road-focused performance for its model line—a line that includes a base model roughly \$100,000 less expensive. It also carries two vestigial rear seats and looks, well, decidedly large and pedestrian in this company.

The raptor-beaked McLaren 570S is proof of the benefits of trickle-down technology. This newest, and least expensive, McLaren nabs a version of the carbon-fiber tub and the 3.8-liter twin-turbo V-8 that form the basis of the company's more expensive offerings, the 650S and P1. Created to steal some money from the Porsche Turbo franchise, the 570S loses the trick hydraulic suspension arrangement and active aerodynamics of its bigger brothers to get the base price down to a class-competitive \$187,400. Our test vehicle was equipped with all manner of options, bringing the total to a hefty \$219,770. While it may be a direct shot at Porsche, with a similar engine displacement and forced-induction arrangement, the McLaren presents a vastly different visage. Even as its engine pumps out the least amount of horsepower (a still quite ample 562), its highly expressive design and its flip-up, not-quite-Lambo doors invariably convince standers-by that it must be in a different league than our other two competitors. The numbers say otherwise.

There are other entries in this class, including the Mercedes-AMG GT S. But that front-engine two-seater lost a comparison test to the less powerful Porsche 911 Carrera GT S. We'll wait for the higher-horsepower GT R [see page 023] to throw that model back into the crucible.

The new Acura NSX also would fit nicely into this group, even with its hybrid powertrain. But alas, when we asked for one, Acura demurred, promising a test car later in the year.

So we terrorized the southeastern United States with these three candy-colored babies. We started by track-testing the junior



Audi R8 V-10 Plus
[+] Glorious engine sounds, comfy ride.
[-] Mute steering, confidence-sapping handling.
[=] Isn't as athletic as its rich brother, the Lamborghini Huracán, but scores high in citizenship.

supercars in Laurens, South Carolina, at Michelin's expansive proving grounds. We then ambled north to the Blue Ridge Mountains where we gave the tires (all Pirellis) a comprehensive exfoliation on the region's sublime mountain roads. Remarkably, not one of us was arrested. None of us purchased a coonskin cap in our home base of Boone, North Carolina. And all the cars remained completely operational at all times. So, it was something like a crossover comparison test, only with 100 percent more adrenaline-drenched joy.

3. AUDI R8 V-10 PLUS

It was on the freeway slog up from South Carolina to the Blue Ridge Mountains that the new-for-2017 Audi R8 V-10 Plus first surprised us. Humming along at the clip of men who will soon need dinner, we noticed, well, that we were not uncomfortable. The



Oddly, the carbon-fiber-bedecked R8 is the most comfortable-riding car of the group. Below: These fake air intakes serve only to generate wind noise.



absence of vice is always harder to discern than the presence of virtue. With its various carbon-fiber body bits, big rear diffuser, and 610-hp V-10, we had reason to believe that the R8 would be a loud, taxing taxi. Instead, it's tremendously comfortable. Its seats are soft. Its steering is light. And its nonadjustable dampers soaked up high-frequency chop as well as they eased the car over undulations. My goodness, we thought: Audi has made this low-slung machine into the everyday supercar. The only sensations upsetting the calm were the roar of fat performance tires over gritty concrete (the others sang just as loudly) and the high-speed wind noise coming from just behind our left ear as the fake scoop behind the side windows grabbed air for no good reason.

We shouldn't have been surprised by the R8's relative comfort. In addition to its novel, cliché-free exterior design, the first-generation R8 was notable for its easy livability. If the R8 V-10 Plus could lay waste to back roads and track and still be a comfortable ride to dinner, we might as well call off the rest of the comparison test and go on a two-day moonshine bender. Alas, it was

	2017 AUDI R8 V-10 PLUS	2016 McLAREN 570S	2017 PORSCHE 911 TURBO S
PRICE AS TESTED	\$202,750	\$219,770	\$192,735
BASE PRICE	\$192,450	\$187,400	\$189,150
DIMENSIONS			
LENGTH	174.3 in	178.3 in	177.4 in
WIDTH	76.4 in	75.1 in	74.0 in
HEIGHT	48.8 in	47.3 in	51.0 in
WHEELBASE	104.3 in	105.1 in	96.5 in
FRONT TRACK	64.5 in	65.9 in	60.7 in
REAR TRACK	63.0 in	63.7 in	62.6 in
INTERIOR VOLUME	54 cu ft	49 cu ft	F: 50 cu ft* R: 17 cu ft*
CARGO	8 cu ft	5 cu ft	13 cu ft
POWERTRAIN			
ENGINE	DOHC 40-valve V-10 318 cu in (5204 cc)	twin-turbocharged DOHC 32-valve V-8 232 cu in (3799 cc)	twin-turbocharged DOHC 24-valve flat-6 232 cu in (3800 cc)
POWER HP @ RPM	610 @ 8250	562 @ 7400	580 @ 6750
TORQUE LB-FT @ RPM	413 @ 6500	443 @ 5000	553 @ 2250
REDLINE/FUEL CUTOFF	8800/8500 rpm	8200/8200 rpm	7000/7200 rpm
LB PER HP	6.0	5.7	6.1
DRIVELINE			
TRANSMISSION	7-speed dual-clutch automatic	7-speed dual-clutch automatic	7-speed dual-clutch automatic
DRIVEN WHEELS	all	rear	all
GEAR RATIO:1/	1 3.13/5.7/49	1 3.98/6.1/50	1 3.91/5.9/43
MPH PER 1000 RPM/	2 2.59/7.5/64	2 2.61/9.3/76	2 2.29/10.1/73
MAX MPH	3 1.96/10.0/85	3 1.91/13.0/107	3 1.58/14.6/105
	4 1.24/12.6/107	4 1.48/16.7/137	4 1.18/19.6/141
	5 0.98/16.6/141	5 1.16/21.6/177	5 0.94/24.5/177
	6 0.98/20.4/173	6 0.91/27.5/204	6 0.79/29.3/205
	7 0.84/24.1/205	7 0.69/36.1/190	7 0.62/37.4/190
AXLE RATIO:1	4.46, 3.59†	3.31	3.44
CHASSIS			
SUSPENSION	F: control arms, coil springs, anti-roll bar R: control arms, coil springs, anti-roll bar	F: control arms, coil springs, anti-roll bar R: control arms, coil springs, anti-roll bar	F: struts, coil springs, anti-roll bar R: multilink, coil springs, anti-roll bar
BRAKES	F: 15.0-inch vented, cross-drilled, ceramic disc R: 14.0-inch vented, cross-drilled, ceramic disc	F: 15.5-inch vented, cross-drilled, ceramic disc R: 15.0-inch vented, cross-drilled, ceramic disc	F: 16.1-inch vented, cross-drilled, ceramic disc R: 15.4-inch vented, cross-drilled, ceramic disc
STABILITY CONTROL	fully defeatable, competition mode, launch control	fully defeatable, competition mode, launch control	fully defeatable, competition mode, launch control
TIRES	Pirelli P Zero F: 245/30ZR-20 (90Y) R: 305/30ZR-20 (103Y)	Pirelli P Zero Corsa F: 245/35ZR-19 (88Y) R: 285/35ZR-20 (104Y)	Pirelli P Zero F: 245/35ZR-20 (91Y) R: 305/30ZR-20 (103Y)
CAR AND DRIVER TEST RESULTS			
ACCELERATION			
0-30 MPH	1.2 sec	1.4 sec	1.0 sec
0-60 MPH	2.9 sec	2.9 sec	2.6 sec
0-100 MPH	6.5 sec	6.1 sec	6.1 sec
0-150 MPH	15.6 sec	13.9 sec	14.6 sec
1/4-MILE @ MPH	10.9 sec @ 129	10.7 sec @ 134	10.6 sec @ 131
ROLLING START, 5-60 MPH	3.5 sec	3.7 sec	3.3 sec
TOP GEAR, 30-50 MPH	2.2 sec	5.2 sec	3.3 sec
TOP GEAR, 50-70 MPH	2.3 sec	3.3 sec	2.2 sec
TOP SPEED	205 mph (mfr's claim)	204 mph (mfr's claim)	205 mph (mfr's claim)
CHASSIS			
BRAKING, 70-0 MPH	153 ft	144 ft	139 ft
ROADHOLDING, 300-FT-DIA SKIDPAD	1.00 g	1.05 g	1.06 g
610-FT SLALOM	47.4 mph	47.3 mph	48.1 mph
WEIGHT			
CURB	3684 lb	3189 lb	3563 lb
%FRONT/%REAR	42.2/57.8	42.1/57.9	39.1/60.9
FUEL			
TANK	19.3 gal	19.0 gal	17.9 gal
RATING	91 octane	93 octane	93 octane
EPA COMBINED/CITY/HWY	17/14/22 mpg	19/16/23 mpg	21/19/24 mpg
C/D 550-MILE TRIP	12 mpg	14 mpg	15 mpg
SOUND LEVEL			
IDLE	48 dBA	63 dBA	61 dBA
FULL THROTTLE	91 dBA	97 dBA	82 dBA
70-MPH CRUISE	72 dBA	74 dBA	74 dBA

*C/D est. †The first ratio is for gears 1, 4, and 5. The second for 2, 3, 6, and 7.



The 570S is a naughty little thing. Below: Just get the standard seats. Opposite: The center stack seems inspired by Sesame Street's Yip Yip characters.

Plus nonetheless allows too much body movement in high-speed transitions. It can feel unsettled. It feels larger than its dimensions suggest. Some of the blame has to go to the variable-ratio steering system, which is feather light and utterly numb. You'll know that the front end has lost grip on corner entry not because you feel it through the steering wheel, but because you see the car start pushing off your intended line.

After one blast down the gorgeous bobbed course of a road known as U.S. Route 221 near Linville, North Carolina, tech director Eric Tingwall remarked: "I'm far less confident driving this than the other two cars. Funny to be driving a 600-plus-horsepower car, look in the rearview mirror, and know you're holding up traffic." Okay, so that traffic consisted of a 911 Turbo S and a McLaren, but still. Dial back the aggression, and the R8 becomes pleasant again. But who wants to do that?

It's a shame that the R8 doesn't acquit itself better in hard driving because the powertrain is almost entirely beautiful. It's certainly lovely to look at, mounted like the jewel it is under the rear glass. Its eagerness to rev past 8000 rpm is a thing of rarity. And the sound it makes, good Lord Almighty, that noise is gorgeous. It is easily

not to be. While trying to turn a supercar into an everyday Audi, the company sacrificed what we consider to be the primary objective of a supercar, junior or otherwise: to drive as if it has a telepathic connection to your id. Despite carrying a stiffer suspension setup than the standard R8's, the

the best-sounding thing in this comparo, possibly one of the best-sounding things, period. There's *Exile on Main Street*, a baby's laugh, and meat sizzling over a flame, but not much else can compare. Full-throttle upshifts are quick and smooth and make us emit an unintentional "Ooh!" as if anyone can hear. We found ourselves making entirely unnecessary shifts just to activate the *RrrrrBRAPrrrrrrBRAPrrrrrrBRAPrrrr* noisemaker. Our only quibble with the Audi's powertrain is the seven-speed dual-clutch transmission's tendency to drop up to five gears at a time (seventh to second, anyone?) at the stab of the throttle. The sudden switch snaps your head forward, the engine roaring for a second, and then it upshifts almost immediately, but not before you think: "Well, now that really was unnecessary shifting."





Don't take our criticisms to mean that the R8 is unimpressive. This is a car capable of launching itself to 60 mph in less than three seconds and on through the quarter-mile in 10.9 at 129 mph. It's mighty quick, even if it weighs 121 pounds more than the Porsche and a whopping 495 pounds more than the McLaren. However, though it wore nearly identically sized Pirelli P Zero tires as the Porsche, the Audi couldn't match its countryman's skidpad, braking, or slalom performances.

We wish, too, that Audi had taken more chances with the exterior design of the new car. It comes off as a first-generation R8 made less distinctive. But its engine reminds us why we still like naturally aspirated powerplants in sports cars, even if this one can't match the off-corner grunt of its turbocharged competitors, and even if it returns the test's worst fuel economy. You care about your junior supercar's fuel economy, right?

2. McLAREN 570S

The McLaren has sport modes for both its chassis and its powertrain, but really, the 570S is itself a sport mode. It is the supercar of junior supercars. The moment you fire up the 3.8-liter twin-turbo V-8, it's spitting mad. Through the \$3860 optional sport exhaust blasts a positively antisocial level of auditory aggression. It produces 97 dBA at full whack. Unless their estates are of considerable acreage, 570S owners are not going to be popular with their neighbors.

Our test car also carried optional one-piece racing seats (\$5960) covered in that raciest of upholstery, synthetic suede. The seats might satisfy some Walter Mitty racer fantasies, but they were uncomfortable for the three drivers we had on the comparo, one of whom is claiming permanent right-hip damage from the unforgiving shells. They further complicate getting into the McLaren, an already-wrenching task. You will not look suave as you crack your noggin on the upraised door, then try to step over the tall, wide carbon-fiber fortress wall, drop your butt into a narrow bucket, and fold your second leg into the car (the suede grabbing your pants and twisting them uncomfortably around your business). Once inside, the shell seat forces your knees together. The pedal box, made tight by the intruding wheel well, forces your feet

McLaren 570S
[+] Proper supercar looks, full boost turns it into a berserker.
[-] Turbo lag, droning exhaust, prolonged use of optional racing seats may cause hip dysplasia.
[=] A live wire into which you can climb.

together. It must be said that some men prefer a wider stance.

A grand-touring automobile this is not. When McLaren said it was going after the Porsche Turbo, it did not mean that it would build a Porsche Turbo facsimile with a McLaren badge. Rather, it built a McLaren that hits similar performance and price targets to the Porsche Turbo. The 570S doesn't want to trundle around town, where its turbos lag. It doesn't want to cross continents on expressways, where it will drone on constantly. It wants only to go fast, to be shot at corner apexes and fired out the other side by enormous boost. It wants to be loud and brash and playful. Even its digital tachometer needle trembles nervously, and its HVAC system's airflow pictogram shows a person wearing a full-face racing helmet. He has no arms, but he has a helmet.





If the above makes it seem as if we don't like the 570S, then we have unintentionally misled you. We mostly love the 570S. Its flavor is distinct and powerful. Out on the back roads, the McLaren dances around on its relatively narrow tires. Its steering wheel is alive with enough feedback to keep tabs on the goings-on down at those tires. Its highly boosted 562-hp V-8, which can feel pretty laggy around town, comes alive on boost above 4000 rpm in the same heady, intoxicating way that a roller-coaster car hangs for a second on the first hill until all the cars crest the top and then off you go. Beyond the huge canopy windshield you see no hood, so steeply does the short little beak drop away. It feels as if your body is being hurled down the road more than it feels as if you're piloting a car.

Of the three assembled, the 570S garnered by far the most attention, even if few had any clue what it might be. One man thought it could be a Vector, which is one of the weirder things a human has said to us in a while.

Like its exterior, the Turbo S's interior looks basically like any old 911's. But the car is capable of gut-wrenching, supercar-humiliating performance.

The 570S's interior is as clearly focused as the car's character. There is nothing extraneous inside. There's just a clear and easy-to-read digital instrument cluster

and a relatively small, vertically oriented infotainment screen, and that's about it. "What else does a supercar need?" the 570S quietly asks. And the answer is nothing at all. Our test car's interior was also lined with slightly fuzzy, soft-to-the-touch synthetic suede (a \$2990 option) that made driving the car feel like wearing a bathrobe. But we don't dislike that, either.

Our scoring system rewards overall excellence, a balance of virtues, so the 570S finished second behind the Porsche Turbo S. But have a look at the Fun To Drive category on the results chart.

1. PORSCHE 911 TURBO S

In the category of Outstanding Achievement in the Production of a Junior Supercar, the Porsche 911 Turbo S is the runaway winner.

Line up these three rides, and the Turbo stands tall and upright, looking, at least in this company, like just a regular coupe. It doesn't have any faux racing addenda; no gleaming, lacquered carbon-fiber bodywork; no rear aerodynamic diffuser; no silly doors. And it speaks softly, with none of the *sturm und drang* of the other two. Even the turbos are demure. The McLaren is forever hissing and raging. But it's easy to miss the subtle breaths of the Porsche's turbos—in the same way you never hear the quick inhalations that people tuck between words when they speak, unless you listen for them specifically.

But the Turbo S carries a very large stick with which to beat those who underestimate it. It accelerates to 60 mph in a mind-scrambling 2.6 seconds, a mere tenth off the Bugatti Veyron's time, and a few tenths quicker than the other cars in this test. It carries its acceleration advantage through the quarter-mile, completing it in 10.6 seconds at 131 mph. This in a car that, at least on paper, has the worst power-to-weight ratio. Like the other vehicles in this test, the Turbo S wears carbon-ceramic brakes (standard on the Turbo S), but it stops from 70 mph in a remarkable 139 feet, five feet shorter than the lighter 570S that came with sticky Pirelli P Zero Corsa tires. The Turbo S stops 14 feet shorter than the R8.

Oh, and the Porsche swept the objective handling tests, too, beating its rivals by a large margin in the slalom and a smaller one on the skidpad. And you can turn on the Porsche's ventilated front seats, should all of this heated action warm you too much.





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CAR AND DRIVER

▶ 2017 PORSCHE 911 TURBO S
Maximum points available

2017 AUDI R8 V-10 PLUS

2016 McLAREN 570S

RANK	1	2	3
VEHICLE			
DRIVER COMFORT 10	9	6	8
ERGONOMICS 10	8	6	7
CARGO SPACE* 5	5	1	3
FEATURES/AMENITIES* 10	10	5	9
FIT AND FINISH 10	9	8	9
INTERIOR STYLING 10	8	8	8
EXTERIOR STYLING 10	7	9	7
REBATES/EXTRAS* 5	0	0	0
AS-TESTED PRICE* 20	20	17	19
SUBTOTAL 90	76	60	70
POWERTRAIN			
1/4-MILE ACCELERATION* 20	20	20	19
FLEXIBILITY* 5	3	3	4
FUEL ECONOMY* 10	10	9	7
ENGINE NVH 10	7	8	9
TRANSMISSION 10	9	7	8
SUBTOTAL 55	49	47	47
CHASSIS			
PERFORMANCE* 20	20	19	17
STEERING FEEL 10	8	9	6
BRAKE FEEL 10	9	9	7
HANDLING 10	8	10	6
RIDE 10	8	7	9
SUBTOTAL 60	53	54	45
EXPERIENCE			
FUN TO DRIVE 25	22	24	19
TOTAL 230	200	185	181



Porsche 911 Turbo S
[+] The corner-launching king, hyper-car-taunting performance; no one will ever mistake it for a Vector.
[-] No one will ever mistake it for a Vector.
[=] A perfectly usable automobile, endowed with superpowers.

More remarkable than mere numbers, though, is the Porsche's demeanor. If a car could be said to be stoic, this one would be. It is utterly unflappable. Treat it with a light touch or a clumsy ham-fist, and it will always respond in a similarly controlled fashion. It makes its drivers look more skilled than they are. When we set out for our runs down the

mountain roads, the Porsche typically led our little caravan. That way we knew the Turbo S wouldn't get held up. Its wide tires, all-wheel drive, and four-wheel steering made child's play of fast driving. And the twin-turbo 3.8-liter flat-six delivers power so smoothly and from such low rpm that the car positively explodes out of corners. Accurate steering and a firm, progressive brake pedal are good enough that you frankly never take note of them.

But after a long, tiring day, the Porsche was also the car we invariably chose to drive to the store for supplies. The Porsche's perfectly behaved seven-speed dual clutch was as imperceptible pattering around town as it was quick and precise on curvy-road runs. We didn't once take the McLaren on a nighttime errand.

The Turbo S will surely be accused of being soulless and inert. We might have leveled that accusation once or twice ourselves. There is a sense that the car is doing much to drive itself without your commanding it to do so. After all, you never asked for its rear wheels to turn or for a certain amount of torque to flow to the front wheels instead of the back. But the Turbo S does have character. It just doesn't have any glaring faults or lapses or flashiness, things that are sometimes misinterpreted as character. ■

*These objective scores are calculated from the vehicle's dimensions, capacities, rebates and extras, and/or test results.



IF THERE'S A DREAM,

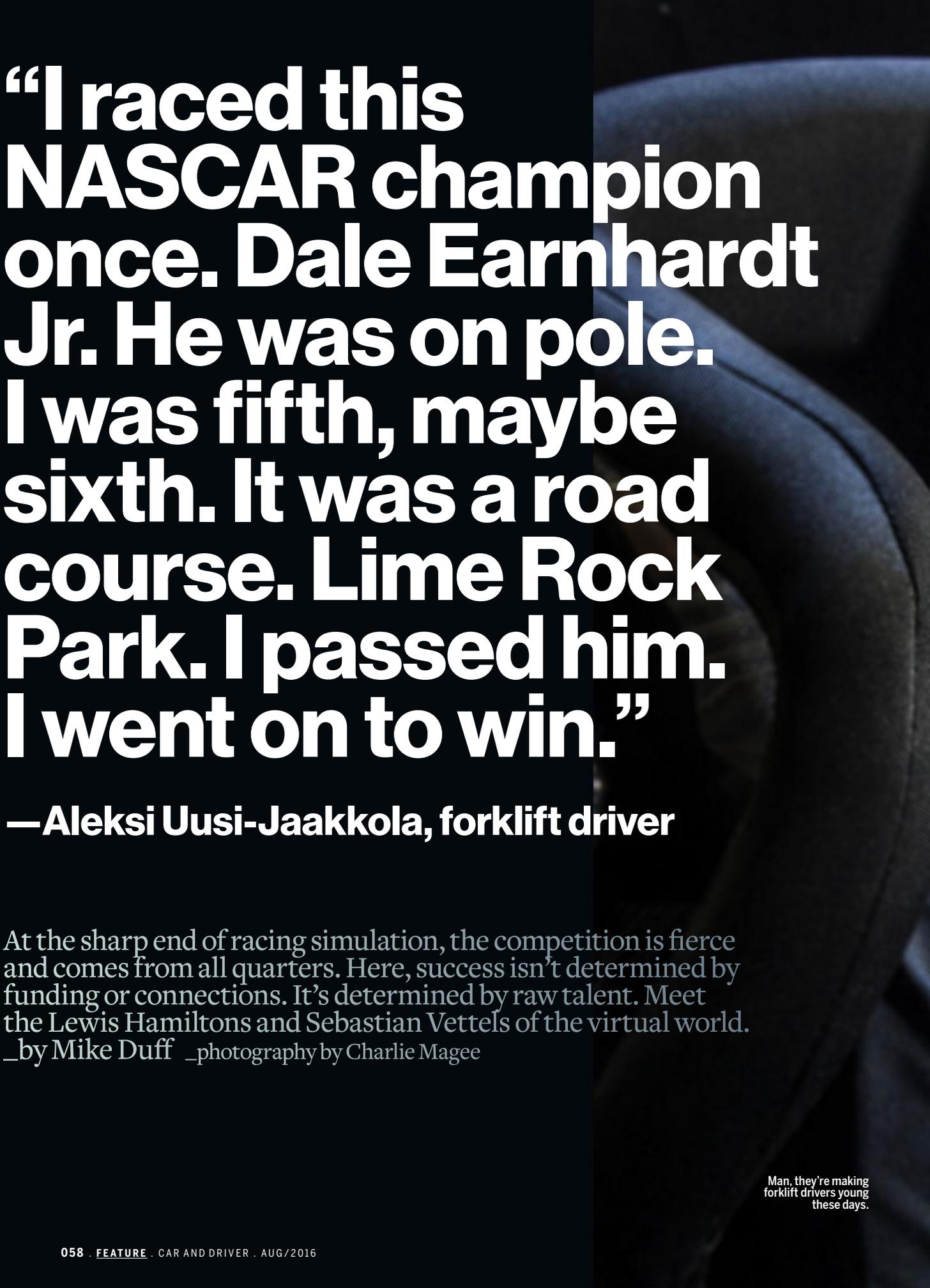
CHASE

 **ACURA**
PRECISION CRAFTED PERFORMANCE

NSX GT3 Race Car shown. ©2016 Acura. Acura, NSX, and the stylized "A" logo are registered trademarks of Honda Motor Co., Ltd.



SEE IT



**“I raced this
NASCAR champion
once. Dale Earnhardt
Jr. He was on pole.
I was fifth, maybe
sixth. It was a road
course. Lime Rock
Park. I passed him.
I went on to win.”**

—Aleksi Uusi-Jaakkola, forklift driver

At the sharp end of racing simulation, the competition is fierce and comes from all quarters. Here, success isn't determined by funding or connections. It's determined by raw talent. Meet the Lewis Hamiltons and Sebastian Vettels of the virtual world.
_by Mike Duff _photography by Charlie Magee

Man, they're making
forklift drivers young
these days.



For a journalist, covering a race at Monza usually involves flying to Milan, renting a small Fiat, and driving to the circuit on the edge of the city. We've touched down instead in Munich, where we'll drive an Opel about 20 miles to the nondescript town of Landslut. There, in an equally unmemorable building, we find three of the most successful racing drivers in the world qualifying for the first round of the Blancpain GT Series World Championship. Not the actual series, but the iRacing version, a video-game simulation that shadows its real counterpart.

You almost certainly haven't heard of these guys, though they've competed against and even beaten some famous racers. Bono Huis is from the Netherlands, Aleksi Uusi-Jaakkola is Finnish, and Kelvin Van Der Linde is South African. Each competes in top-flight sim racing for Team Redline, one of the virtual world's most successful racing organizations. Yet this is the first time any of them has met; Huis is a student, Uusi-Jaakkola's day job is a forklift driver, and, in an interesting twist, Van Der Linde is an actual racing driver competing as a works pilot for Audi.

More for our benefit than theirs, this trio has gathered to contest this GT3 endurance race at the headquarters of its main team sponsor, Fanatec, a manufacturer of high-end virtual-racing gear. The showroom is filled with "rigs," or structures that look like roll cages fitted with proper race-car seats and steering wheels and pedals. Drivers face one or more high-resolution monitors, giving our surroundings the feel of a video arcade. But this is no glorified Pole Position; virtual motorsports has grown in sophistication and stature such that it is now attracting talent from the real racing world. Redline made headlines last year when it announced that it had signed Formula 1 driver Max Verstappen, who has since gone on to become the youngest-ever Grand Prix winner.

Sim racing is part of the larger trend of competitive video gaming, only recently emerged from Midwestern basements and the smoky cyber cafes of South Korea to find legitimacy as "eSports." Last year a championship tournament in Seattle for Dota 2, an online battle-arena game, handed out more than \$18 million in prizes. That's big business, the likes of which virtual motorsports is still chasing. Online championships have been held for years, with iRacing claiming 65,000 active users worldwide. But sim racing has so far been spared the taint of professionalism by a simple absence of money, making the iRacing Blancpain GT Series novel in that it has a \$25,000 prize fund. This purse is enough to draw the cream of online racing, with 1600 drivers and 400 teams entering the qualifying series last fall. Only the top 40 teams were invited to compete in the championship, which begins with this Monza race.

Embedding ourselves proved to be a challenge. Online racing is the sort of solitary activity that, like certain other solo passions, is normally pursued in the privacy of bedrooms or dens. But our needs led Redline to gather its stars in Germany. The team competes in practically all forms of online racing, from Gran Turismo

on up, and enters all the iRacing championships, including Formula 1, NASCAR, and now GT.

Although Verstappen isn't competing today, the team is ready to race. Uusi-Jaakkola and Van Der Linde are teammates, driving a pixel-perfect Audi R8 LMS GT3. In practice, their best times at the virtual Monza track are separated by just a tenth of a second. Huis, a five-time Formula SimRacing world champion, pilots one of Redline's other cars, a Mercedes-AMG GT3. His teammate, Christian Szymczak, competes from California, where he's had to set his alarm for five in the morning to make the grid.

We're surrounded by Fanatec's expensive rigs that tilt and even pivot their seats to relay g-forces and yaw. However, none of the three drivers here actually compete with those systems switched on; they grew up in sim racing where they are used to responding to what they see rather than what they feel. We notice that both Huis and Uusi-Jaakkola also prefer to use single monitors rather than the triple array of the more expensive systems. Fanatec CEO Thomas Jackermeier says it's possible to spend up to \$25,000 on one of his company's rigs, meaning that many customers are in their 40s or older. "Lots of the guys who want this stuff have pretty nice cars already," he says, "or even go racing."

You don't need to spend seven figures to go iRacing, though. Huis, who competes on a tight budget befitting his student status, figures it takes about \$500 for a decent steering wheel and \$1100 for a top-spec computer. Beyond talent, it doesn't take much to compete at the highest level here. The iRacing software is pitched as a simulator rather than a game, costing only \$99 a year for the basic package that includes some cars and tracks, with others available for more money. It's popular with both amateurs and professionals, as evinced by Audi's Van Der Linde.

Audi factory driver Kelvin Van Der Linde, top, competes against Bono Huis, bottom, a student. That sort of thing doesn't happen on the real GT3 grid.

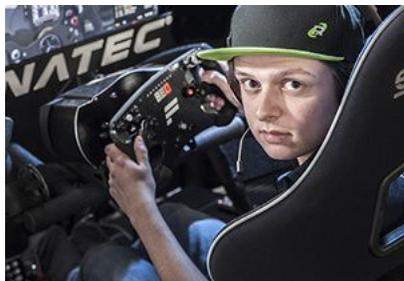
Part of sim racing's appeal is that it gives fans the ability to compete against the sort of star driver who likes to unwind from racing with a little more racing. "I raced this NASCAR champion once," says Uusi-Jaakkola in an understated, staccato English. "Dale Earnhardt Jr. He was on pole. I was fifth, maybe sixth. It was a road course. Lime Rock Park. I passed him. I went on to win."

The qualifying session is broadcast live on YouTube, which confirms that online racing still has a way to go to match the real thing. The graphics are good but don't have the perfectly rendered slickness of mega-budget console games. Cars stop on the track or sometimes disappear when drivers opt out of noncompetitive laps by hitting the reset button.

The emphasis is on the modeling of the cars and their physics, so tracks are laser scanned to millimeter accuracy. Over the course of a race, the surface changes as virtual rubber is laid on the most heavily used lines, increasing grip. "It's close, really close," says Van Der Linde, who is almost

uniquely qualified to compare the real with the virtual. "If there's a big bump on the track, then it will be in the game."

Cars are modeled with similarly obsessive focus. For the Blancpain championship, teams can choose from four GT3 cars. Besides the Mercedes-AMG GT3 and the Audi R8 LMS GT3, there's a BMW Z4 and a McLaren MP4-12C. "When the R8 was launched in iRacing, I still had a setup sheet from a test session we'd done the





previous week,” says Van Der Linde, “so I put it into the game, absolutely identical, and it was a winning setup out of the box.” Van Der Linde raced the real R8 GT3 at the real Monza last year, and his best iRacing lap is within half a second of his real time.

Qualifying takes place just 15 minutes before the start of the three-hour race. Uusi-Jaakkola qualifies the R8 in a disappointing 19th place. Huis does better, placing the AMG GT3 ninth. The pack is tight; the two cars are within two-tenths of a second. But the race is somewhat anticlimactic from our vantage point, with near silence in the room itself.

Van Der Linde and Huis are driving the first stints, staring intently at their monitors and wearing headsets to talk to other team members who are acting as spotters and crew chiefs. There’s some mumbled

talk over the team’s communication channel, punctuated by louder swearing in both Finnish and English as things go wrong—or possibly right. But the most noise comes from the ceaseless clacking of the gear-change paddles. We feel more like voyeurs than spectators.

The racing is surprisingly sensible. You might imagine that a lack of physical risk or repair bills would create the sort of consequence-free environment where anything goes. The reality is anything but, as there’s a penalty system that gives competitors demerits for making contact with another car or for transgressing the track limits. Much of the practice session seems dedicated to discovering just where those are. Tallying enough demerits triggers an automatic black flag, and online race officials also scrutinize controversial moves with the ability to award further penalties. The largest outburst of the day comes from Huis after he collides lightly with another car, earning four penalty points.

The result is a race with lots of strategy and relatively few passing moves from the equally matched pack, certainly for the cautious first hour. Fuel conservation is also critically important, causing Uusi-Jaakkola to spend a decent chunk of his first stint drafting other cars rather than fighting for position. The drama of real endurance racing does play out, with Uusi-Jaakkola and Van Der Linde dropping as low as 29th after a 15-second penalty for speeding in the pit lane before fighting their way back up to finish 11th. The Mercedes, running even higher, crashes passing a backmarker and suffers damage, finishing 15th.

It strikes us that there needs to be a way to simulate a fixture of real GT3 racing: the kamikaze Russian billionaire who wants to treat the whole thing like a demolition derby. As it is, there are few crashes, and the ones we do see are, frankly, disappointing. A BMW Z4 half-rolls as it leaves the track sideways and then hangs for a moment in midair. Impact modeling is clearly considered frivolous at this point. If it’s explosions you seek, play *Call of Duty*.

Unquestionably, sim racing is more fun for participants than spectators, and this will only become more true as the simulators evolve. The next big thing, according to Fanatec’s Jackermeier, is virtual reality, with drivers wearing headsets to produce a far more immersive experience. “We’ve had people try it and then try to take their racing gloves off when they get out of the car,” he says.

With sim racing’s low risk and high reward, it’s easy to see the appeal. Even if spectating isn’t so different from watching real motorsports on television, it certainly beats watching someone make a wizard chase an ogre through a castle. And it’s refreshing to have discovered that rarest of things: an almost pure meritocracy. When forklift drivers can go head to head with works racers and beat NASCAR champions, that’s good racing. ■



Keeping it real

Ever since Polyphony Digital’s *Gran Turismo* game made its debut on PlayStation in 1997, software developers have been making big claims for the accuracy of their modeling. Nowadays, they are closer to reality than they’ve ever been.

In the case of iRacing, the car models are based on either a manufacturer’s original CAD files or laser scanning. Scans are done with the bodywork both on and off, then augmented by using thousands of photographs of every visible surface to create scalable textures. The models start with millions of polygons, the basic building block of 3-D modeling, and are reduced to around 130,000 polygons for the cars you see racing.

iRacing’s virtual physics are even more comprehensive. The simulation mirrors many variables, including the size and shape of the suspension components and how they interact, with the solutions of this “multi-body model” calculated up to 360 times a second. If a chassis setting can be changed on a real car, it’s usually possible to do so on its virtual equivalent. Tire modeling considers the outer dimensions, the construction, and the compound, with wear factoring in according to track temperatures and driving styles. There’s even a simulation of the way the track “rubbers in” as material is shed, complete with marbles off the racing line. —MD

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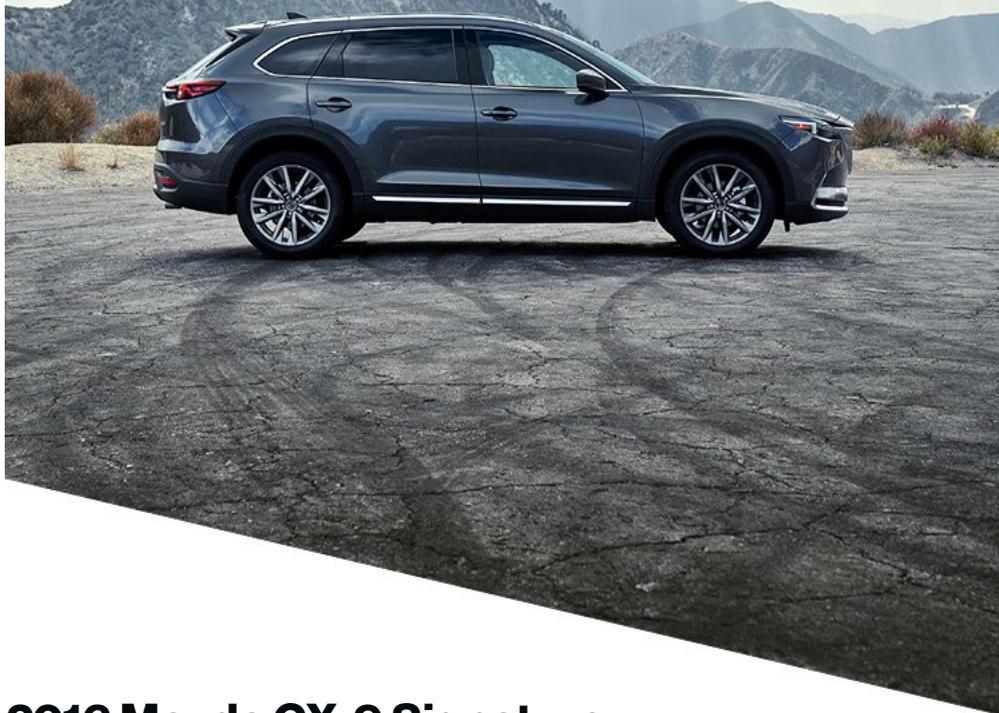


PRACTICAL MAGIC

Three-row crossovers are the new minivans. They haul families and stuff with increasingly bland sameness. But what if there existed an affordable option that's attractive and fun to drive?

_by Tony Quiroga

_photography by Webb Bland



2016 Mazda CX-9 Signature ▲

We talk a big game. After endlessly professing our love for Chevy Corvettes, Porsche Caymans, and Mazda MX-5 Miatas, more often than not, when the time comes to pick a vehicle for a weekend road trip, we choose something practical. Practical is three rows. Practical is all-wheel drive. Practical is quiet. Practical rides well. Practical doesn't make us look as if we're suffering a mid-life crisis. And practical gets driven. In our long-term fleet, the vehicles that rack up 40,000 miles the quickest are always minivans and three-row SUVs. As much as we love driving them, sports cars can't accommodate the family or carry much stuff.





by round analog dials. But unlike in almost every other Mazda, one of the round gauges is actually a color LCD screen that can display trip-computer information and a compass. On all but the lowest Sport trim level, which gets a seven-inch screen, there's an eight-inch touchscreen in the middle of the dashboard. It's a bit too far to touch while driving, so the screen can also be controlled by the BMW iDrive–like knob behind the shifter. Navigation and audio controls are logical and easy to use with either the knob or the touchscreen.

In the second row, there's ample space for adults, provided they slide the split bench all the way back. However, second-row legroom comes at the expense of third-row space. Unlike some competitors, Mazda doesn't offer captain's chairs in the second row. The split-bench second row folds forward to ease entry into the way back, but the Ford Explorer, Honda Pilot, and Toyota Highlander, with their second-row walk-throughs, make it easier. The competition also beats the CX-9's two-person third row. The Mazda's rear-most row is kid-friendly, but the Highlander's and the Pilot's work better for adults, and each can theoretically hold three. There is a 14-cubic-foot cargo hold in the Mazda, and folding its third row increases that to 38 cubic feet. With both rows folded flat, there's 71 cubic feet of space, but the Mazda is on the smaller end of the three-row spectrum. Also, you'll be doing the folding yourself as power-folding seats aren't available.

And while the rest of the class offers V-6 power, the CX-9 comes with only a four-cylinder turbo. The engine displaces 2.5 liters and makes 250 horsepower on 93 octane and 227 horses on 87, says Mazda. On California's 91-octane fuel, it makes something in between and can run zero to 60 mph in 7.2 seconds. It passes through the quarter-mile in 15.7 seconds at 88 mph. The Pilot and Explorer Sport are both quicker to 60 by about a second; the V-6-powered Highlander is about a tenth slower than the CX-9.

Mazda tells us that it studied how buyers use their three-row-mobiles and found that they almost never rev the engine past 4500 rpm. The power just above idle is more important. To provide punch where owners want it, the CX-9's engine makes 310 pound-feet of torque at 2000 rpm, regardless of octane. That torque translates into a nice firm shove from low revs, and it gives the big CX-9 the ability to squirt into holes in traffic. The throttle response is excellent, even from idle, with boost that builds instantly, likely due to the clever Dynamic Pressure Turbo system [see "Explained"]. But if you drive the CX-9 as we do—part throttle and no redlining makes Jack a dull boy—the power tapers off noticeably. It doesn't fall away with the abruptness of a turbo-diesel, but there's

So the Mazda CX-9 is practical, but it's not all Costco and Home Depot and road trips to Disney. The CX-9 looks like something Karl Lagerfeld would use to run errands on whatever his version of a nice little Saturday might be.

A wholesale redo, the new CX-9 lifts the design idioms of Mazda's own CX-5 but also borrows some styling cues from the Infiniti QX70 (the SUV formerly known as the FX). The big Mazda, especially on its optional 20-inch wheels, looks elegant enough to wear a designer badge. Some of what makes the Mazda appear expensive is actually its restraint. Yes, the large chrome grille juts menacingly forward and has LED lighting inside it, but Mazda's designers appear to have sculpted the clay with hands when forming the CX-9, rather than hacking at it with swords. Even the Mazda's paint looks like a budget breaker. Covered in a finely flaked hue called Machine Gray, the CX-9 glows. This SUV has the presence and style to rival Acura's MDX and Infiniti's QX60.

It's the same story inside. Mazda's material choices look and feel rich. Many of the plastics are so finely grained and soft to the touch that they appear to be bovine based. On our top-spec Signature tester, sticker price \$45,215, there are open-pore rosewood trim pieces, aluminum accents, and soft brick-colored Nappa leather seats. The gaps are consistently tight, and the trim all lines up with an obsessive attention to detail.

In an effort to bring the CX-9's noise levels upmarket, Mazda tells us it worked on suppressing the tire roar that plagued the previous CX-9. The replacement has a thicker floorpan, 53 pounds of sound deadening under the carpet, and an acoustically laminated windshield and front windows. The work pays off with a low 65 decibels of noise at 70 mph, four less than the last CX-9 we tested and the same as the Tesla Model X. Our only gripes up front are related to the seats. The driver's chair doesn't go low enough and needs more thigh support, and the passenger's seat produces the same complaints while lacking any height adjustment.

As in the CX-9's brethren, the instrument panel is dominated



The CX-9 steals more than one trick from Porsche. Its rightmost gauge contains a screen, as in Macans and Cayennes. Further, it looks poised to run.

a big drop in enthusiasm beyond 4500 rpm.

According to Mazda, using a four instead of the old 3.7-liter V-6 saves 132 pounds. Front-drive models weigh 4054, a loss of 269 pounds. We measured 4336 for our all-wheel-drive CX-9 Signature, 223 pounds less than the old CX-9. It's between 200 and 700 pounds lighter than most of the three-row class, but the Pilot, Hyundai Santa Fe, and Kia Sorento are a few pounds lighter still.

The downsized engine and reduced mass help boost EPA fuel economy from last year's 16 city/22 highway mpg (AWD) and 17/24 (front drive) to 21/27 and 22/28, respectively. Those numbers are good enough to take the CX-9 to the head of the class; the GMC Acadia [see page 104], with the newly available naturally aspirated 194-hp 2.5-liter four and all-wheel drive, comes close at 21/25 mpg.

To boost real-world fuel economy, Mazda fits a cooling system to the exhaust-gas-recirculation system that helps reduce combustion temperatures. When on boost, a turbo causes the engine to consume more fuel, not only to match the extra air entering the engine but also as a little extra to help keep the combustion chamber cool. By cooling the exhaust that recirculates back to the engine, combustion temperatures are thus reduced without having to rely on a rich mixture.



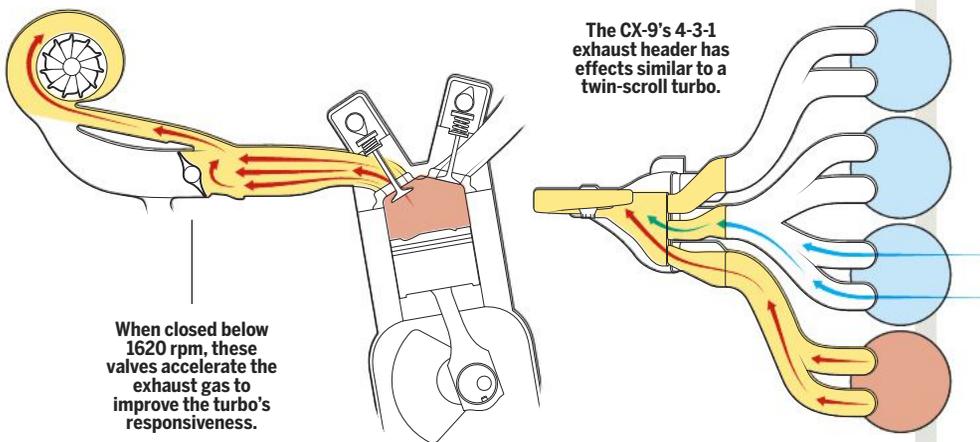
[+] Beauty in commuter clothes, high mpg, drives like a champ.
[-] Not as voluminous as the leviathans in its class.
[=] A big SUV that doesn't act like one.

Mazda tells us that while the system's benefits don't show up on the light-throttle, almost-no-boost EPA test, there will be a benefit for real drivers. We rarely drive like real people, though, so we managed only 19 mpg over nearly 500 miles.

All drivers will find the CX-9 is as smooth and charismatic as it appears. The electrically assisted power steering is light and accurate. Like all Mazdas, the CX-9 is easy to place on the road. With 20-inch wheels, the suspension tuning is on the firm side of supple. Push the CX-9 hard, and it never feels as ponderous as the mini-van-like Highlander and Pilot. Switch the six-speed automatic into sport mode, and the CX-9 almost starts to think it's an MX-5 Cup car. The gearbox snaps through downshifts under braking and gears are held longer.

Explained: Dynamic Pressure Turbo

The Dynamic Pressure Turbo system fitted to the CX-9's 2.5-liter engine combines elements of twin-scroll and variable-geometry turbos in one small package. Like a variable-geometry turbo, the CX-9 constrains exhaust flow at low rpm to accelerate the gases, which helps spool up the turbo. It produces the same result as putting your thumb over the end of a hose, but instead of doing so inside the turbine housing, as in a variable-geometry turbo, Mazda puts its "thumb over the hose" upstream. The valve body fits between the cylinder head and the turbocharger. Below 1620 rpm, the three valves are closed, forcing exhaust gas into the smaller passages above the three but-



When closed below 1620 rpm, these valves accelerate the exhaust gas to improve the turbo's responsiveness.

The CX-9's 4-3-1 exhaust header has effects similar to a twin-scroll turbo.

flies. The constricted path accelerates the gas into the turbine and improves the turbo's low-rpm responsiveness. At 1620 rpm, the exhaust volume is great enough that the valves open and the turbo operates normally.

To manage the exhaust pulses as in a twin-scroll turbo, Mazda separates the engine's waste gases into three distinct

branches with a 4-3-1 exhaust manifold built into the head. The two inner cylinders blow their exhaust into a common runner, while the outer cylinders push their exhaust through individual pipes. Separating the gases has two effects: First: Scavenging uses the fast-moving exhaust gases from a cylinder beginning its exhaust stroke to

help draw out the remaining low-pressure waste gas from the cylinder just starting the intake stroke in the adjacent passage. Second: By separating the exhaust into three pathways, the turbocharger is hit with more evenly metered pulses, like a twin-scroll turbo. Those timed pulses improve responsiveness and help reduce turbo lag. —TQ

We measured 0.80 g of grip in skidpad testing despite an overactive stability-control system. Even on public roads, we found the stability control a bit too intrusive. It can't be shut off, and if you press hard into a corner, it'll clamp down on the brakes. Should you need to slam on the brakes, stopping from 70 mph takes 179 feet, a typical distance for the class.

For the safety conscious, Mazda offers a full cache of driver-assistance systems, including blind-spot monitoring, radar-based cruise control, and lane-departure warning and correction. Only Grand Touring and Signature models get the radar-based active cruise control that makes the collision-warning system possible. If the vehicle senses an imminent collision, it will slam on the brakes. It's too sensitive. Three times in as many days, the system thought an accident was developing when there was no danger. It surprised us by slamming on the brakes twice while gradually slow-

ing behind a row of cars at a red light, and once again when changing lanes to dart around a slower car. The system can be shut off and its sensitivity can be adjusted (both times when the system intervened, it was set to its least sensitive setting), but it automatically reactivates every time the engine starts. The overactive system is completely inconsistent with Mazda's driver-centric gospel.

Annoying collision-warning system aside, the new CX-9 is the most engaging vehicle in its class, proving that practicality doesn't always mean giving up handling and style. What it lacks in third-row space, it makes up for in refinement and dynamics. A base CX-9 starts at \$32,420; add all-wheel drive for \$1800. Even fully loaded to \$45,215 as our test car was, the CX-9 remains a strong value in a world where a Pilot Elite costs \$47,470 and an Explorer Platinum costs \$53,915. It might not have the acceleration or third-row space of those two, but what's more practical than saving money? ■

2016 MAZDA CX-9 SIGNATURE

PRICE AS TESTED **\$45,215**
 BASE \$44,915

VEHICLE TYPE: front-engine, all-wheel-drive, 7-passenger, 4-door hatchback
OPTIONS: Machine Gray metallic paint, \$300
AUDIO SYSTEM: satellite radio; minijack, 4 USB, and Bluetooth-audio inputs; 12 speakers

ENGINE

turbocharged and intercooled Miller-cycle inline-4, aluminum block and head
BORE X STROKE 3.50 x 3.94 in, 89.0 x 100.0 mm
DISPLACEMENT 152 cu in, 2488 cc
COMPRESSION RATIO 10.5:1
FUEL DELIVERY SYSTEM direct injection
TURBOCHARGER Mitsubishi TD04
MAXIMUM BOOST PRESSURE 17.4 psi
VALVE GEAR: double overhead cams, 4 valves per cylinder, variable intake- and exhaust-valve timing
REDLINE/FUEL CUTOFF 6600/6100 rpm
POWER 250 hp @ 5000 rpm
TORQUE 310 lb-ft @ 2000 rpm

DRIVETRAIN

TRANSMISSION: 6-speed automatic with manual shifting mode
FINAL-DRIVE RATIO 4.41:1
ALL-WHEEL-DRIVE SYSTEM: full time with an electronically controlled clutch-pack coupling

GEAR	RATIO	MPH PER 1000 RPM	MAX SPEED IN GEAR (rpm)
1	3.49	5.6	35 mph (6100)
2	1.99	9.8	62 mph (6100)
3	1.45	13.5	84 mph (6100)
4	1.00	19.6	122 mph (6100)
5	0.71	27.6	133 mph (4800)
6	0.60	32.7	133 mph (4050)

CHASSIS

unit construction
BODY MATERIAL: steel and aluminum stampings

STEERING

rack-and-pinion with variable electric power assist
RATIO 17.6:1
TURNS LOCK-TO-LOCK 3.1
TURNING CIRCLE CURB-TO-CURB 38.8 ft

SUSPENSION

F: ind, strut located by a control arm, coil springs, anti-roll bar
R: ind; 1 trailing arm, 2 lateral links, and a toe-control link per side; coil springs; anti-roll bar

BRAKES

F: 12.6 x 1.1-in vented disc, 2-piston sliding caliper
R: 12.8 x 0.4-in disc, 1-piston sliding caliper
STABILITY CONTROL traction off

WHEELS AND TIRES

WHEEL SIZE 8.5 x 20 in
WHEEL CONSTRUCTION cast aluminum
TIRES Falken Ziex CT50 A/S, 255/50R-20 104V M+S

EXTERIOR DIMENSIONS

WHEELBASE 115.3 in
LENGTH 199.4 in
WIDTH 77.5 in
HEIGHT 67.6 in
FRONT TRACK 65.3 in
REAR TRACK 65.2 in
GROUND CLEARANCE 8.8 in

INTERIOR DIMENSIONS

SAE VOLUME F: 54 cu ft M: 30 cu ft
CARGO BEHIND F: 71 cu ft M: 38 cu ft R: 14 cu ft

CAR AND DRIVER TEST RESULTS

ACCELERATION

ZERO TO	SECONDS
30 MPH	2.3
40 MPH	3.7
50 MPH	5.2
60 MPH	7.2

70 MPH	9.7
80 MPH	12.9
90 MPH	16.6
100 MPH	21.3
110 MPH	30.1
ROLLING START, 5-60 MPH	7.7
TOP GEAR, 30-50 MPH	3.6
TOP GEAR, 50-70 MPH	4.9
1/4-MILE	15.7 sec @ 88 mph
TOP SPEED (GOV LTD)	133 mph

HANDLING

ROADHOLDING, 300-FT-DIA SKIDPAD 0.80 g*
UNDERSTEER MINIMAL

BRAKING, 70-TO-ZERO MPH

SHORTEST STOP 179 ft
LONGEST STOP 186 ft
FADE RATING NONE

WEIGHT

CURB 4336 lb
PER HORSEPOWER 17.3 lb
DISTRIBUTION F: 54.7% R: 45.3%
TOWING CAPACITY 3500 lb

FUEL

CAPACITY 19.5 gal
OCTANE 93 (for max power)
EPA COMBINED/CITY/HWY 23/21/27 mpg
C/D OBSERVED 19 mpg

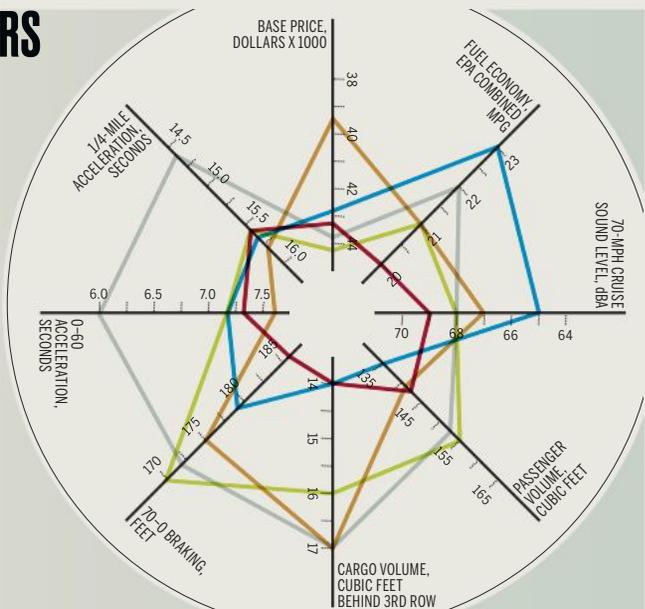
INTERIOR SOUND LEVEL

IDLE 41 dBA
FULL THROTTLE 70 dBA
70-MPH CRUISING 65 dBA

COMPETITORS

The CX-9's dynamic virtues are easier perceived than measured, while its tight interior dimensions can be both felt and quantified.

- **DODGE DURANGO AWD**
3.6-L V-6, 295 HP, 8-SP AUTO
- **HONDA PILOT AWD**
3.5-L V-6, 280 HP, 9-SP AUTO
- **MAZDA CX-9 AWD**
2.5-L I-4, 250 HP, 6-SP AUTO
- **NISSAN PATHFINDER AWD**
3.5-L V-6, 260 HP, CVT
- **TOYOTA HIGHLANDER AWD**
3.5-L V-6, 270 HP, 6-SP AUTO



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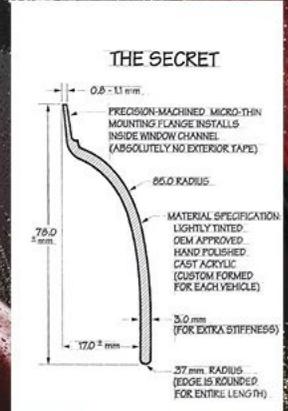
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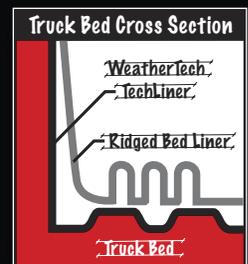
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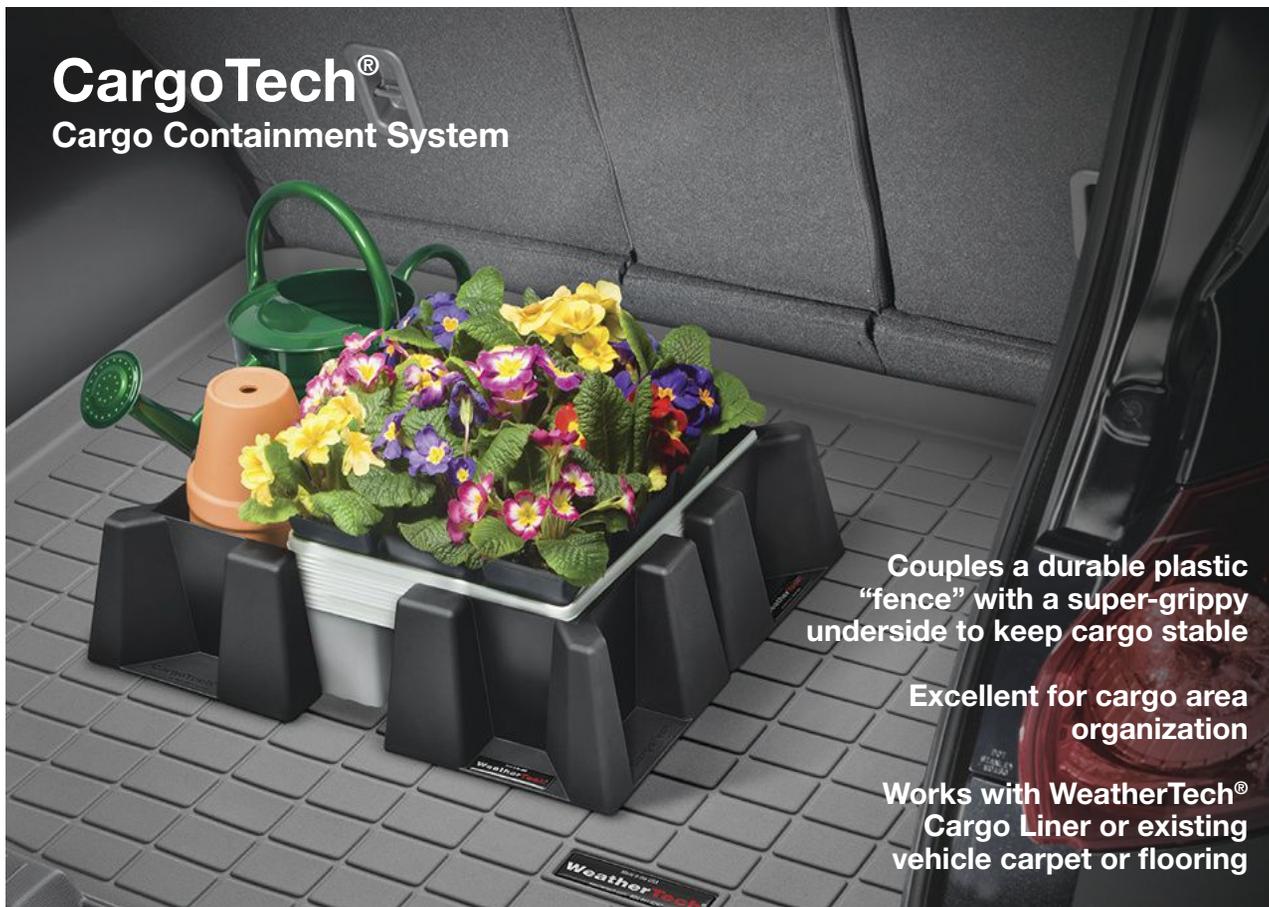


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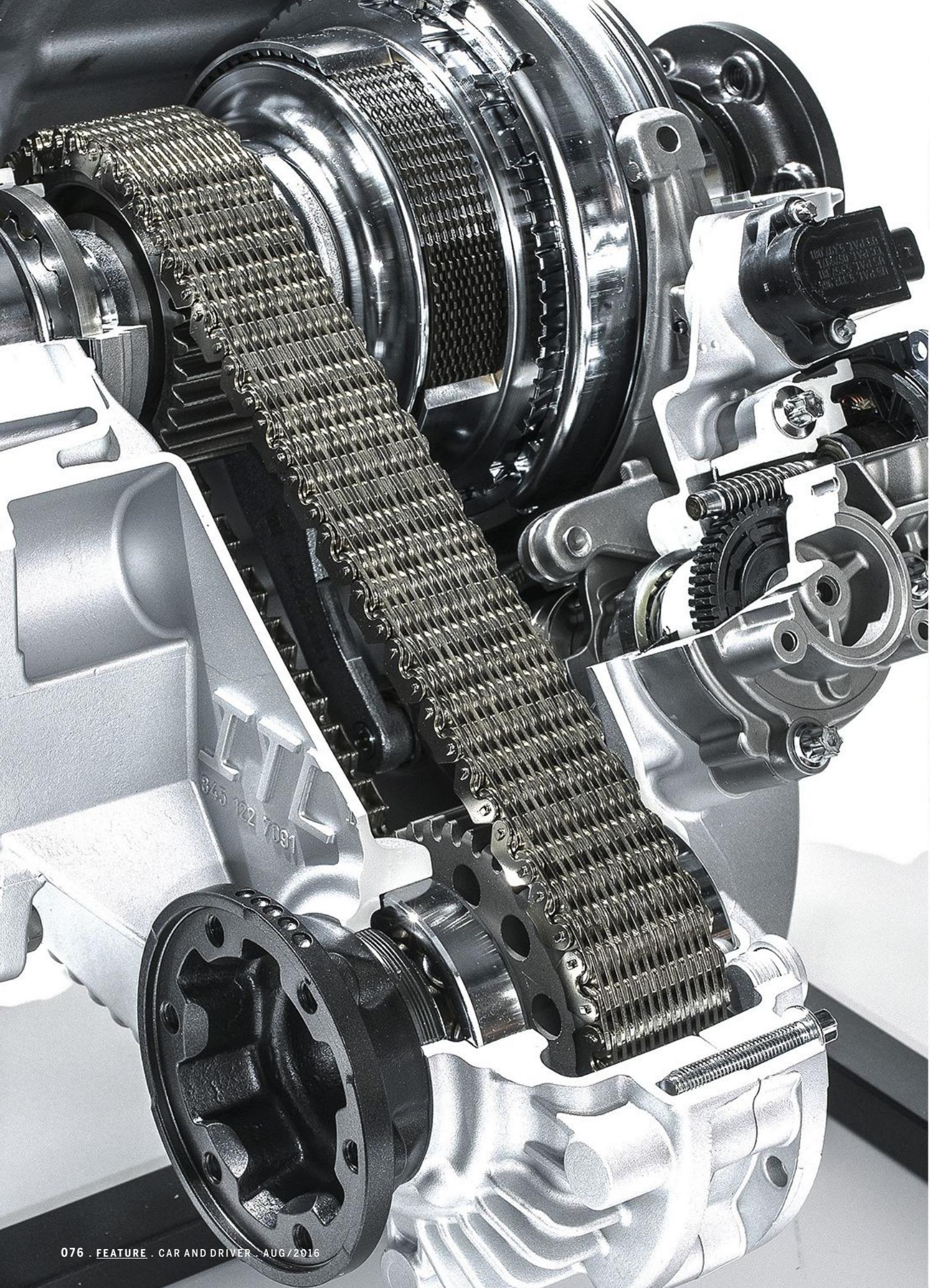
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FOUR ON THE FLOOR

BY JOSH JACQUOT
PHOTOGRAPHY BY ROY RITCHIE

ALL-WHEEL-DRIVE SYSTEMS ARE PROLIFERATING THROUGH THE CAR MARKET LIKE SO MANY TRIBBLES ON KIRK'S STARSHIP *ENTERPRISE*. THESE SYSTEMS PROMISE ALL-WEATHER ASSURANCE AS WELL AS DRY-ROAD DYNAMIC BENEFITS, AND MANY CAR BUYERS BELIEVE THEM TO BE ESSENTIAL TO ANY NEW-VEHICLE CHECKLIST. BUT NOT EVERY ALL-WHEEL-DRIVE SYSTEM IS CREATED EQUAL. HERewith, SPLITTING SOME HAIRS OVER HOW ALL-WHEEL-DRIVE SYSTEMS SPLIT TORQUE.

Torque, despite its industrious reputation, is lazy. Left undirected, like toddlers or teenagers, it will frustrate, always preferring the path of least resistance. And in automotive terms, that most frequently means spinning tires. Not that we mind spinning tires, but since an engine's job is to get us where we want to go, harnessing its torque to accomplish that task is only pragmatic.

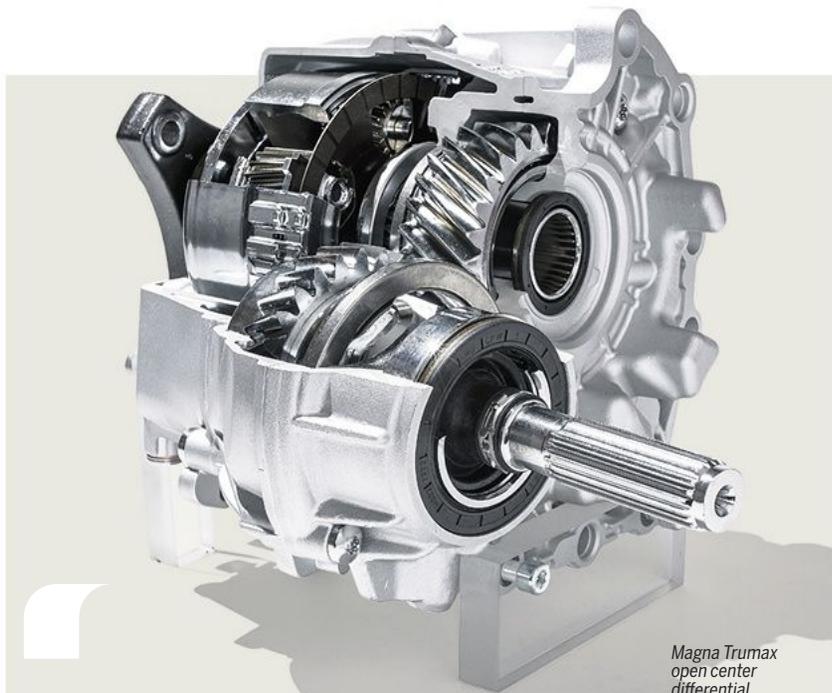
Thus, all-wheel drive, which divides the work of moving us not among two wheels but among four. How today's all-wheel-drive vehicles direct torque is varied, but doing it well means distributing the right amount of torque to the right wheels at the right time.

Notice that we wrote all-wheel drive, not four-wheel drive. It's a distinction that matters in these pages. By our definition, four-wheel-drive vehicles, mainly trucks, can only lock their front and rear drive shafts so that each axle always turns at the same speed. And they do it that way whenever they're driving all four wheels. It's a little elementary, sure, but quite often so are the problems trucks aim to solve. Like crawling up steep, rocky trails. Or yanking boats up moss-covered launch ramps. Or our favorite, jumping over cars in beer-doused arenas.

If your goals are more ambitious—like turning, for example—there are more-effective ways of dividing torque to the front and rear axles than simple transfer cases. One of them is to forgo a mechanical connection altogether and power one axle with electricity. By powering its front wheels with an electric motor, Porsche's 918 Spyder recalibrated not only our definition of rapid but also our definition of all-wheel drive. Yet it's not alone in the world of the electrically driven axle. Appearing at the other end of the performance spectrum is Toyota's RAV4 hybrid crossover, which powers its rear wheels exclusively with an electric motor.

Gas/electric all-wheel-drive systems, which are still in their infancy, range wildly in cost and purpose, and e-axle vehicles are outliers. Though their popularity is increasing, only a handful are sold in the U.S. today.

Many of today's all-wheel-drive vehicles rely on the far more common center differential, which is a proven means of controlling torque delivery to both axles. Most, however, are on-demand systems based on front-wheel-drive powertrains. What follows is a closer look at the most popular hardware used by today's all-wheel-drive vehicles to direct power to the ground:



Magna Trumax
open center
differential

OPEN DIFFERENTIAL

The humble open center differential—simple, reliable, cheap—has been driven to near extinction by electromechanical alternatives that offer more control and greater efficiency. An open differential, a variation of the common planetary gear set found in automatic transmissions, splits a single torque input (the transmission) into two outputs (the front and rear axles) but allows them to rotate at different speeds. Yet open diffs have no means of limiting the speed variation between the two outputs, so torque is free to follow the path of least resistance. Hence, it's possible for a vehicle to become stuck with one wheel spinning furiously while the others remain stationary. Most modern vehicles compensate with a cheap but effective combination of software and existing hardware that uses the brakes to create a reaction torque at the slipping wheel, closing the path of least resistance

and thus increasing the torque applied to the wheels with more traction.

Open differentials also can be paired with driver-selectable lockers, as in the Mercedes-Benz G-class, which can lock together both the front and rear axles, as well as the left and right wheels. A locked differential is akin to having no differential at all, establishing a solid link connecting axles and wheels to the transmission. But the drivetrain will bind and buck once the vehicle reaches high-grip surfaces such as paved roads, where it needs its differentials back for the reason they were invented: to compensate for significant differences in wheel speeds while turning.

[+] Simple, inexpensive [-] Limited control over torque distribution
Found in: Jeep Grand Cherokee Laredo, Mercedes-Benz G-class

Torque Split: The Gripping Truth

Whenever manufacturers talk about their all-wheel-drive systems, there's always blather about where the torque is going and in what proportion. This is all theoretical, based on assumptions that are rarely true. When wheelslip occurs in the real world, torque distribution is ultimately determined by the available traction at each tire. That makes torque split a function of load transfer and the friction of the road surface, as much as it is a consequence of the differential configuration. When a manufacturer talks about a 50/50 torque split, it assumes equal grip at each axle, a condition that is unlikely to occur in any situation where you most need all-wheel drive. Likewise, the ability to send 100 percent of the torque to a single axle typically does not mention the caveat that the opposite axle must be spinning its wheels on a surface with almost no friction. (On-demand couplings are the exception to this, as some can send 100 percent of the torque to one axle by decoupling the other.) Because both grip and weight distribution are constantly changing, the quoted torque splits become largely meaningless in the real world. Think of manufacturers' torque-split talk as akin to promises from presidential candidates: When reality sets in, results may vary. —JJ

LIMITED-SLIP CENTER DIFFERENTIALS

Still relatively simple, these passive center differentials react to changes in torque—either at the wheels or from the engine—to redirect the engine's motive force to the axle with more grip. They drive all four wheels all the time and rely only on physics, a predictable ally in our experience, to do their job. Forgoing sensors, actuators, and driver intervention means that they are an effective way to couple the front and rear axles while still maintaining the ability to vary the front-to-rear torque distribution. It also means that they keep cost, weight, and complexity relatively low. They come in several varieties:

VISCOUS CENTER DIFFERENTIAL

These differentials couple the front and rear driveshafts via a series of plates submerged in synthetic fluid inside a sealed housing. When wheelslip causes one shaft's speed to vary significantly from the other, the fluid's properties change, allowing the two shafts to rotate at, or closer to, the same speed.

[+] *Inexpensive, lightweight, smooth engagement* [-] *Requires wheelslip to produce locking force*

Found in: Subaru WRX and Crosstrek with manual transmissions

HELICAL CENTER DIFFERENTIAL

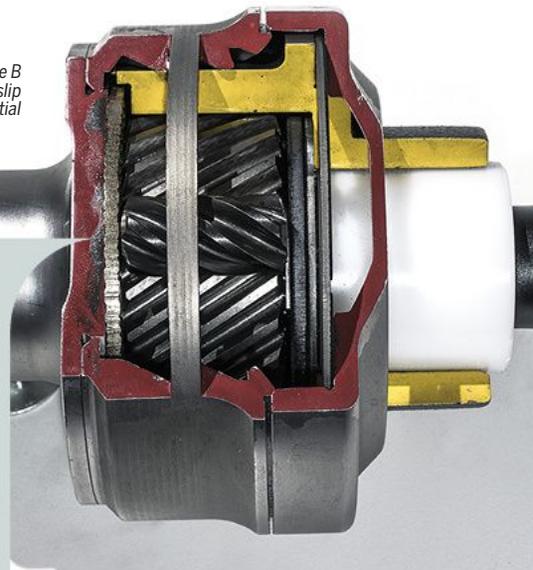
Helical limited-slip differentials, commonly called by the brand name Torsen, are more complicated. These units use carefully tuned planetary-gear arrangements with teeth cut in a helical spiral pattern (think DNA) that bind up or push against friction discs to limit wheel-spin and alter the torque distribution. Increasing torque from the engine creates more friction to enhance the locking action. The locking rate of this type of differential is determined by the angle at which the gear teeth are cut: Steeper angles produce more locking force. When used as center differentials, helical limited-slip diffs are often designed to offer an unequal torque bias—an effect determined by the ratio between the gears that drive the front and rear axles.

[+] *Reacts to torque changes from both the engine and slipping wheels*

[-] *Nonadjustable—locking force determined by gear angle and torque applied, requires resistance at the wheels to produce locking effect*

Found in: Audi A8, Bentley Continental GT, Land Rover Range Rover Sport

Torsen Type B helical limited-slip center differential



ELECTRONICALLY CONTROLLED LIMITED-SLIP CENTER DIFFERENTIAL

Functioning similarly to passive limited-slip differentials, these use electric or hydraulic actuators (or both) to engage a clutch that limits slip between driveshafts. The primary advantage here is the ability to function independent of engine torque or friction at the wheels. Using inputs from a series of sensors and computer controls, these diffs offer the full range of operation from fully open to fully locked whenever needed to best suit driving conditions. In recent years, manufacturers have been getting creative in their command of electronically controlled differentials, adding algorithms to predict when more slip is helpful or when preemptively engaging the clutch will prevent wheelspin before it occurs. Similarly, electronic controls make center-differential behavior tunable across various drive modes, which optimizes their performance for different surfaces and different levels of driving aggression.

[+] *Highly adjustable* [-] *Complex, costly*
Found in: Subaru WRX STI

Magna ITC electronically controlled limited-slip center differential



ON-DEMAND COUPLING

Up to this point we've been talking about systems that drive all four wheels all the time through a center differential. On-demand systems operate differently in that they primarily drive only one axle until the coupling engages the opposite axle for assistance. Clutch packs are commonly used here, but so are toothed couplings called dog gears. Often the hardware sits just ahead of the secondary axle, though some systems decouple on both sides of the driveshaft to improve efficiency. Wherever the coupling is located, its mission is the same: Engage the assist axle progressively as needed.

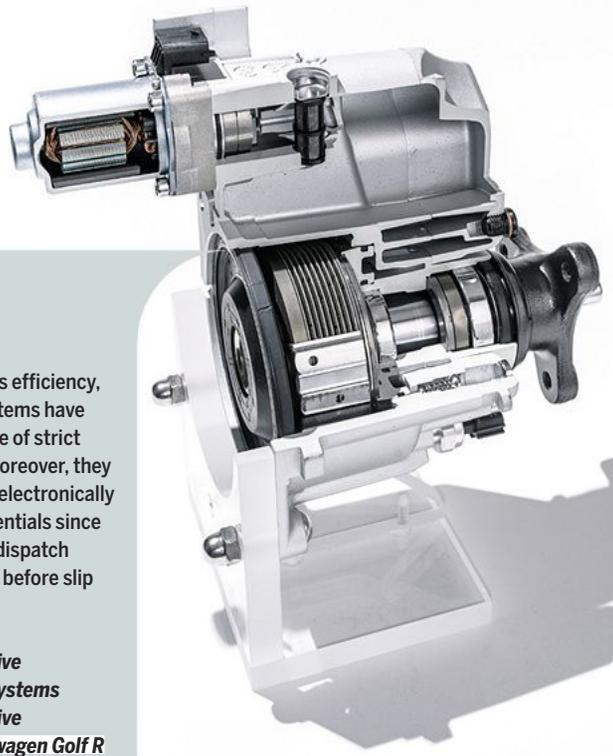
A clutch-pack coupling increases the torque routed to the assist axle by increasing the clamping force on the friction discs, but these systems typically use lighter-duty hardware than full-time systems use because they only drive the second axle a small percentage of the time. Defaulting to two-wheel

drive operation also improves efficiency, which is why on-demand systems have become so popular in this age of strict fuel-economy regulations. Moreover, they offer most of the benefits of electronically controlled limited-slip differentials since they can be programmed to dispatch torque to the secondary axle before slip is detected.

[+] **Improved efficiency relative to full-time all-wheel-drive systems**

[-] **Not full-time all-wheel drive**

Found in: Mazda CX-5, Volkswagen Golf R



Magna Dynamax on-demand clutch-pack coupling

ON-DEMAND TWIN REAR-AXLE COUPLINGS

These systems build on the concept of on-demand couplings with a dedicated clutch pack for the left and right rear-axle half-shafts. The rear axle houses conventional ring and pinion gears but no differential. With the clutches fully engaged, these systems function like truck-based four-wheel drive. However, because the clutches offer both rapid and partial engagement, these systems can avoid the binding common to four-wheel drive. Progressively and independently actuating the clutch packs mimics a vehicle with conventional center and rear limited-slip differentials.

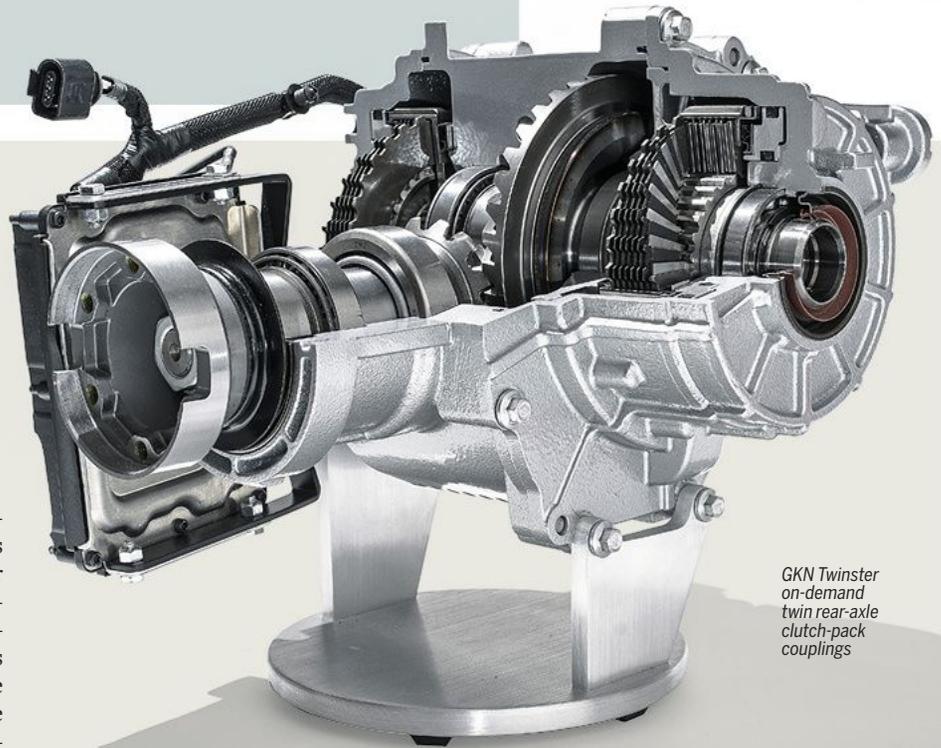
Another advantage to twin-clutch systems is that torque vectoring is easily achieved by changing one axle ratio. Ford's Focus RS, for example, uses this

type of system with a rear-axle final drive that is 2.7 percent shorter than what's used on its front axle. The effect is a rear torque bias and an increased "push" from the back. Anytime the rear clutch packs are engaged, the rear wheels receive more torque and try to turn faster than the front wheels. Either the clutches compensate for the speed difference or the wheels spin. But the urge to spin certain wheels faster creates a motive force that pushes the car from the back.

Torque can be split left to right across the rear axle as well. Put it all together and you get the Focus RS's drift mode, and we can hardly think of a more compelling argument for all-wheel drive than that.

[+] **Inherent left/right torque biasing, torque vectoring is possible with a gear-ratio offset** [-] **Heavily burdened clutches require careful thermal management**

Found in: Acura TLX, Ford Focus RS ■



GKN Twinster on-demand twin rear-axle clutch-pack couplings

TOYOTA CAMRY

A bold style shaped by hand.

Our designers used handcrafted instruments and proprietary clay to help shape the aggressive styling and sleek lines of this car. It's something we don't usually talk about. That's because the bold look speaks for itself.



Let's
Go
Places

Prototype shown with options. Production model will vary. ©2015 Toyota Motor Sales, U.S.A., Inc.

Long-Term Test: When the tires get worn and the factory warranty runs out, that's where we come in. *Car and Driver* is your source for the 40,000-mile evaluation.

2015 BMW M3

Arrival: Oct/2014
Departure: Feb/2016

Seventeen months with the latest incarnation of the vaunted M3 suggests that we should be spending our days at the track.
—by Jeff Sabatini



BMW has been unafraid to tailor its M3 to the times. Over the past 29 years, the M3's cylinder counts and transmission choices and even body styles have changed. These moves have had corresponding effects on comfort, luxury, and reliability, yet the M3 has always maintained its status as a no-compromise machine. Each of its five generations has offered a slightly different balance between street and track performance, with the underlying idea that this car could excel spectacularly at both disciplines. But after spending 17 months with the latest M3, we've come away thinking that Munich's scales need recalibrating.

The M3 is still a wonderful performer; it puts up numbers as easily as LeBron James

playing pickup at the Cleveland YMCA. At the end of our test, the M3 ran 12.4 seconds in the quarter-mile at 116 mph, pulled 1.01 g's on our skidpad, and stopped from 70 mph in 155 feet, excellent figures that are essentially unchanged from the car as new.

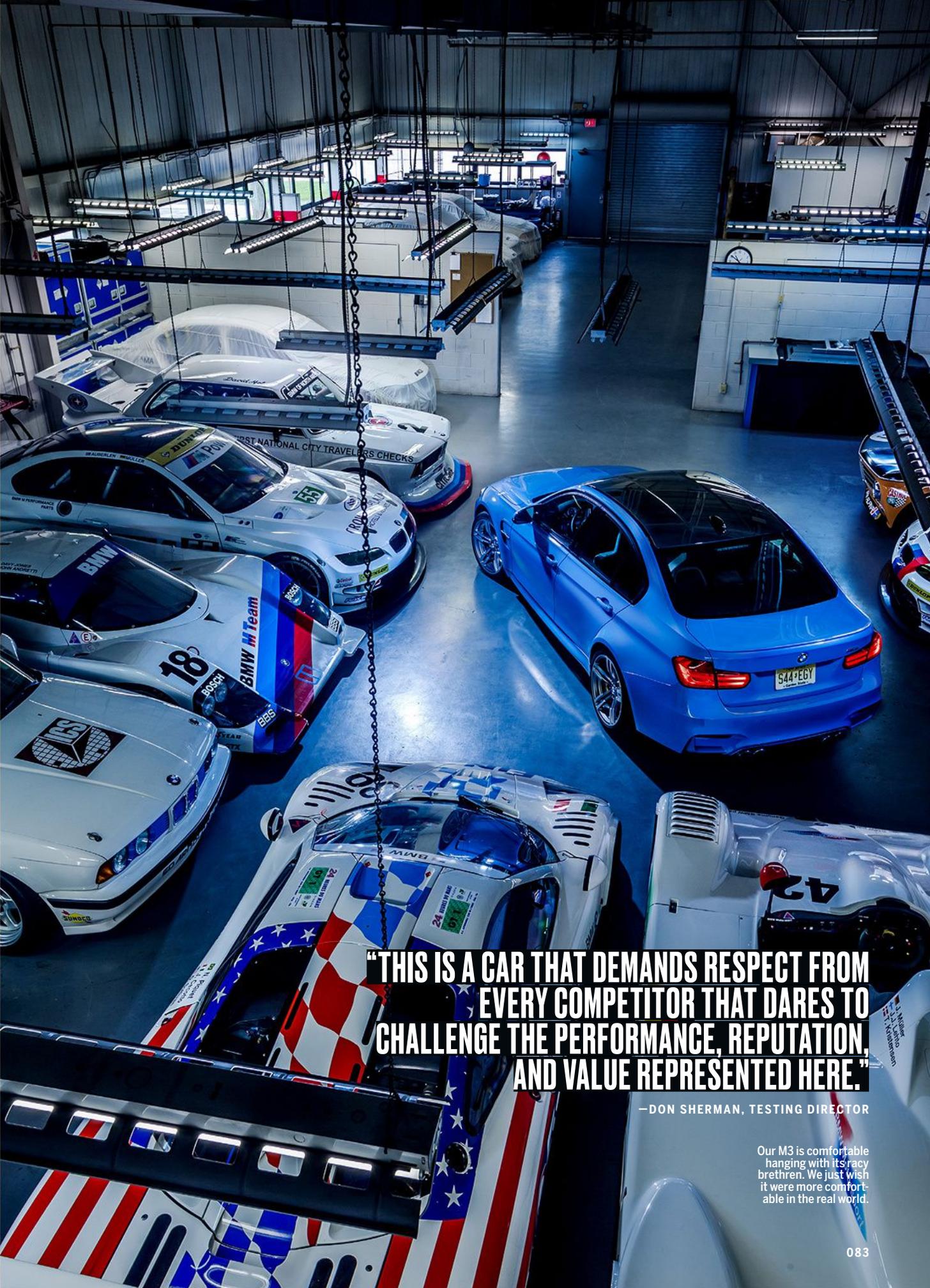
Its 425-hp twin-turbocharged inline-six accelerates with a ferocity to match anything on the street. Ditto the ease with which the driver can summon oversteer with a mash of the throttle. Testing director Don Sherman said it succinctly: "The M3 is lovely to drive flat-out." If we had put 40,000 miles on the car strictly with lapping sessions or on manicured canyon roads, we might have come away with a different opinion. Alas, subjected to normal road use, the M3 was often frustrating.

It started with the \$81,425 sticker price. Maybe if this had been a psychologically more appealing \$79,995, the logbook commenters wouldn't have spent so much time grumbling about the expense, which was smeared over every other complaint like so much proverbial icing. ("For \$80K?! No.") Our well-established disappointment with BMW's latest F30 3-series and vivid memories of the outstanding previous-generation M3, with its high-revving V-8, didn't help. Surely, we thought, throwing this much money at the 3-series would make it wonderful. Not so.

Hindsight says that we should not have loaded up our car with \$18,475 in options. With a base price of just \$62,950, trimming the bill of sale would have been simple. We could have saved \$8150 by sticking with the cast-iron brake discs rather than the pricey carbon ceramics; spent \$1200 less by going

Rants & Raves
"Everyone hates this car for what it isn't, rather than liking it for what it is."
—K.C. Colwell

"Look, M3. I still respect you, I do. But I don't love you anymore. Regards, Dan."
—Daniel Pund



"THIS IS A CAR THAT DEMANDS RESPECT FROM EVERY COMPETITOR THAT DARES TO CHALLENGE THE PERFORMANCE, REPUTATION, AND VALUE REPRESENTED HERE."

—DON SHERMAN, TESTING DIRECTOR

Our M3 is comfortable hanging with its racy brethren. We just wish it were more comfortable in the real world.



with standard 18-inch wheels; and cut another \$1000 by forgoing the adaptive suspension. Not only would those choices have dropped the MSRP by more than \$10K, the resultant car would have better suited us and the cratered, third-world goat paths we call roads here in the Midwest. It might have fared better, and probably stopped better—or, at least, with less drama. So blame some of the following on our decision to test the car fully outfitted.

Upon arrival, our M3 beguiled even as it sat. Its Yas Marina Blue over cream (“Silverstone”) palette did much to distract us from the humdrum and dated 3-series interior. A fierce face, flat and stretched low to the ground, looks the business, and no carmaker has such a flair for flared fenders as BMW. Aesthetically, the M3 benefits immensely from those huge wheel arches, absent on its M4 coupe sibling. And look at the way that carbon-fiber roof sparkles in the sunlight. Suffice it to say that nobody would utter a word of criticism about the car’s looks during its tenure here.

Our issues were more subdermal. On cold startups the M3’s muffler was loud, but not a good loud, not the Jaguar F-type’s or Dodge Hellcat’s joyful noise. The exhaust rattled like one of those YouTube videos where they destroy an iPhone in a blender, and at a volume that would only be acceptable if the car were parked in a paddock rather than our driveways. Thus, four months into the test, we had the dealer investigate and then replace an actuator in the muffler. Then we took the car back several months later to have the actuators worked on some more. Then the dealer replaced the muffler itself. The car is still cacophonous at cold start, though quieter.



Once underway there’s plenty of road noise from the M3’sMichelins, but the engine, aided by the extra tones that BMW Active Sound pumps through the audio system, roars above it. The M3 pulls like an ox all the way to redline, meaning that even without downshifting from sixth it has plenty of passing power.

If only the car rode better. We’ve criticized the standard 3-series for being too soft, with insufficient wheel control, but the M3 is like Papa Bear’s chair. Maybe it was the 19-inch wheels, but none of the adaptive suspension’s settings delivered a “just right” ride quality. “You never forget that you’re driving a hard-core sports sedan,” wrote online copy chief Rusty Blackwell.

Even set to comfort, the M3 has the compliance of a race car. It pounds heavily over cracked pavement and freeway expansion joints, magnifying every imperfection in the road. We’d swear the chassis even gets jostled by painted lane markings and the shadows of telephone poles. And the ride got worse as the miles piled up. “The more I drive this as it gets older, the more I dislike how much it crashes over bumps,” wrote copy editor Jennifer Harrington after returning from a road trip.

By the end of our test, enough

Rants & Raves

“This is a nice car and the power and response are intoxicating, but I’m never really sad to get out of it and I never miss it.”
—Mike Sutton

“Even in the comfort setting, the dampers aren’t what I’d call comfortable.”
—Rusty Blackwell

“I wish this were more like an E36 or E46, with one suspension tune and one steering setup.”
—Erik Johnson

“Wow, rain on a carbon-fiber roof is loud.”
—Jared Gall

“This car is dangerously fun to drive.”
—Carolyn Pavia-Rauchman

Service Timeline: Maintaining a legend, maintenance included.

Key: ● - Repairs ● - Damage ● - Maintenance
● - Normal Wear ● - Oil Additions

October 7, 2014
1418 miles: M3 arrives in Ann Arbor with a 1400-mile head start, having been driven rather than shipped from South Carolina

November 10, 2014
3649 miles: Pirelli Winter SottoZero Series II tires fitted for winter

February 4, 2015
9361 miles: Exhaust at startup sounds like a dozen bolts tumbling in a clothes dryer. Dealership replaces the actuator that controls the right exhaust flap, \$0

February 6, 2015
9422 miles: Inflation kit used to breathe life

into a flat front tire. An inspection reveals no damage; the canister of tire sealant is replaced, \$17

March 25, 2015
12,790 miles: First maintenance visit for oil change and inspections, \$0

April 24, 2015
14,839 miles: Michelin Pilot Super Sport tires reinstalled for summer

June 14, 2015
21,147 miles: M3 embarks on its longest road trip, reaching Huntsville, Alabama, by way of the Dragon

July 29, 2015
24,621 miles: Oil change and cabin air filter replacement, \$0
● Exhaust rattle persists, so our dealer removes and reinstalls the actuators, \$0

August 17, 2015
26,243 miles: Dealer replaces muffler (but

reuses the actuators) to finally quiet the exhaust rattle, \$0

September 25, 2015
28,705 miles: Both front wheel bearings replaced to silence clicking sounds, \$0





shock waves had been sent through the car that the interior had accumulated more rattles than Babies “R” Us. There was a time when BMW tuned every M car’s suspension right to the threshold of harshness without crossing over into unacceptably firm. Now, with adjustable suspensions predominant in its portfolio, the company seems to have lost sight of where that magic mark is.

The multitude of adjustments offered for not just the suspension but also for the steering and throttle drew no raves. Some drivers complained that the three steering settings only dialed up effort but did nothing to improve road feel, which, as in other recent BMWs, is lacking. Others grumbled about not being able to turn off the rev-matching feature of the M3’s six-speed manual transmission, save for selecting the most aggressive sport-plus throttle mapping, the one you’d use at the track.

Fitted with the optional carbon-ceramic brake package, our M3 was prepped for pit lane. Race-car brakes produced race-car stops, but also race-car scares. When cold and wet, say just after leaving a car wash on a winter day, our M3’s brakes would sometimes go absolutely numb, the pedal becoming rock hard with no sensation of friction. A quick pumping of the pedal returned braking feel, but not without first eliciting abject panic from the driver.

Our striking Yas Marina Blue M3 came alive on abandoned back roads. When cold and wet, the optional carbon-ceramic brakes occasionally played dead.

After experiencing this more than once, one of our staffers insisted that he was going to start carrying a spare pair of underwear in the glovebox. As shocking as glovebox underwear can be, what’s even more galling is that, according to BMW, this is the way the brakes are supposed to work.

BELLY OF THE BEAST

001 ACTIVE EXHAUST AMPS UP THE DECIBELS UNDER CERTAIN CONDITIONS. IT MADE OUR M3 SOUND LIKE A 15-YEAR-OLD BEATER AT STARTUP.

002 WITH OPTIONAL CARBON CERAMICS, THE BRAKE PADS SEEMINGLY LAST FOREVER, BUT OCCASIONALLY FAIL TO BITE WHEN COLD AND WET.

003 WHILE ITS ORIGINS WERE NEVER CONFIRMED, WE BELIEVE THE “SPACE SASQUATCH” LIVES IN THE STEERING RACK.



October 15, 2015

● **30,299 miles:** Nail punctures left-rear tire. Repaired at a local tire shop, \$0

November 18, 2015

● **32,364 miles:** Winter tires fitted and replacements for rear summer tires (worn out in 20,000 miles) ordered, \$743

December 13, 2015

● **35,283 miles:** One quart of oil added after dashboard notification

December 30, 2015

● **36,389 miles:** Oil change and inspections, \$0

January 5, 2016

● **36,682 miles:** Return to dealer to finish prior service. Engine air filter, spark plugs, and wiper blades replaced, \$0

● Driver’s floor mat replaced under warranty because Velcro that holds it in place had detached, \$0

February 23, 2016

● **40,000 miles:** M3 completes its duty in 17 months

OPERATING COSTS (FOR 40,000 MILES)

MAINTENANCE \$0
 NORMAL WEAR \$743
 REPAIR \$0
 GASOLINE (@ \$2.79 PER GALLON) \$5073

DAMAGE AND DESTRUCTION

REPLACE TIRE SEALANT \$17

SERVICE

DEALER VISITS (SCHEDULED/UNSCHEDULED) ... 4/3
 DAYS OUT OF SERVICE 7
 UNSCHEDULED OIL ADDITIONS 1qt

SEP/15 OCT/15 NOV/15 DEC/15 JAN/16 FEB/16 MAR/16



There's even a page of explanation in the owner's manual. At least the brake pads (\$828 for all four corners) should outlast the car, as they lost less than 0.02 inch of friction material in 40,000 miles.

Our dealer displayed a similar nothing-to-see-here attitude when, late in the test, we started experiencing a noise coming from the front end of the car during left-hand turns. It seemed like a vibration of some sort and sounded like Chewbacca, which made it more amusing than most hard-to-diagnose noises. After some back-and-forth with the service department, which was unable to reproduce the problem and insisted nothing was wrong, we gave up.

In fact, some of us even gave up on driving the M3. When we tallied its mileage and compared it with our last long-term M3, we found that we'd been averaging nearly 500 fewer miles per month than we put on the 2008 model. So much for this being the enthusiasts' poster child, the car that you pry out of our cold, dead hands. But the M3 was inexpensive to keep on the road, with BMW covering service costs for four years or 50,000 miles (downgraded to three years or 36,000 miles for 2017).

Maybe the next owner of our long-term M3 will be able to troubleshoot the Wookiee under the fender. Perhaps he will be more tolerant of the M3's flinty ride. Or better yet, he could just convert it to a full-time track toy; the car is probably ready to assume that life anyway, and the track is where this M3 belongs.

Rants & Raves

"The engine and the view over the domed hood are underrated. Everything else about this car is overrated."
—Alex Stoklosa

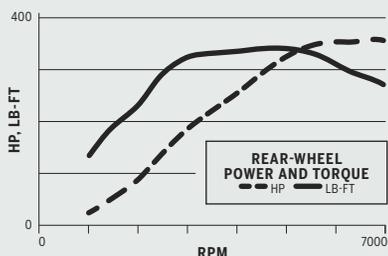
"I enjoy the sound, sometimes, but it does get a little obnoxious. I don't know how much of it is artificial noise coming through the speakers, but I'm going to guess a lot."
—Jennifer Harrington



2015 BMW M3

PRICE AS TESTED **\$81,425**
BASE PRICE **\$62,950**

VEHICLE TYPE: front-engine, rear-wheel-drive, 5-passenger, 4-door sedan
ENGINE TYPE: twin-turbocharged and intercooled DOHC 24-valve inline-6, aluminum block and head, direct fuel injection
DISPLACEMENT 182 cu in, 2979 cc



POWER 425 hp @ 7300 rpm
TORQUE 406 lb-ft @ 1850 rpm
TRANSMISSION 6-speed manual
WHEELBASE 110.7 in
LENGTH 184.5 in
WIDTH 73.9 in
HEIGHT 56.1 in
CURB WEIGHT 3559 lb

WARRANTY

4 years/50,000 miles bumper to bumper
4 years/50,000 miles powertrain
12 years/unlimited miles corrosion protection
4 years/unlimited miles roadside assistance
4 years/50,000 miles scheduled maintenance

MODEL-YEAR CHANGES

2016: Satellite radio, passive entry, and a Harman/Kardon stereo, all previously optional, are now standard equipment. Chrome accents class up the window switches, climate and audio controls, and vents.

CAR AND DRIVER TEST RESULTS

PERFORMANCE	
ZERO TO 60 MPH:	
NEW	4.0 sec
40,000	4.1 sec
ZERO TO 100 MPH:	
NEW	9.0 sec
40,000	9.0 sec
ZERO TO 150 MPH:	
NEW	23.0 sec
40,000	23.0 sec
ROLLING START, 5-60 MPH:	
NEW	4.8 sec
40,000	4.7 sec
1/4-MILE:	
NEW	12.3 sec @ 116 mph
40,000	12.4 sec @ 116 mph

BRAKING, 70-0 MPH:

NEW	157 ft
40,000	155 ft

ROADHOLDING, 300-FT-DIA SKIDPAD:

NEW	1.01 g
40,000	1.01 g

TOP SPEED (GOVERNOR LIMITED)

NEW	163 mph
-----	---------

EPA FUEL ECONOMY, COMBINED/CITY/HWY

NEW	20/17/26 mpg
-----	--------------

C/D-OBSERVED FUEL ECONOMY

NEW	22 mpg
-----	--------

LIFE EXPECTANCIES

(ESTIMATED FROM 40,000-MILE TEST)

FRONT TIRES	45,000 miles
REAR TIRES	20,000 miles
FRONT BRAKE PADS	more than 100,000 miles
REAR BRAKE PADS	more than 100,000 miles

WHAT BITS AND PIECES COST

HEADLAMP	\$1792
ENGINE AIR FILTER	\$33
OIL FILTER	\$18
WHEEL (FRONT/REAR)	\$1100/\$1070
TIRE (FRONT/REAR)	\$283/\$358
WIPER BLADES (PAIR)	\$58
FRONT BRAKE PADS	\$515

5-YEAR ESTIMATED COST OF OWNERSHIP

YEAR	1	2	3	4	5	TOTAL
DEPRECIATION	\$27,325	\$7050	\$6300	\$6250	\$4700	\$51,625
FINANCING	\$2172	\$1720	\$1254	\$773	\$275	\$6195
FUEL	\$1984	\$1664	\$1977	\$2114	\$2250	\$9989
INSURANCE	\$4136	\$4202	\$4282	\$4368	\$4455	\$21,444
TAXES AND FEES	\$4216	\$90	\$85	\$82	\$76	\$4549
MAINTENANCE AND WEAR	\$0	\$755	\$755	\$607	\$2424	\$4541
REPAIRS	\$0	\$0	\$0	\$460	\$1050	\$1510
TOTAL	\$39,833	\$15,481	\$14,654	\$14,653	\$15,230	\$99,852

Depreciation data from ALG. Based on 15,000 miles per year.

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NOW ...with Junk-K Fighter, our latest breakthrough.

Can you spot the difference?



▶ ESP added to enable info sharing with auxiliary devices.

2011

Can you spot the difference? **



▶ Longer range: warning distance increased on Ka-band.

2005

The first V1 detail you see—the Radar Locator: It's a Valentine One invention. Where's the radar? Or laser? A red arrow points to the source.

But you can't see "Continuous Improvement." We don't do model changes. Instead, when we have a new trick, it goes into V1 immediately.

All new components inside. Over the years, our engineers have made 26 major performance revs inside V1. In effect, they've changed everything. We want our customers to get our very best ideas as soon as we can build them.

Our newest trick we call Junk-K Fighter. Like most of V1's improvement, you can't see it. It's a software algorithm that recognizes unthreatening K-band alerts and preemptively excludes them. You won't hear a thing. Our customers call it a breakthrough.

Junk-K Fighter is built into every new V1. Can we build one for you?

Can you spot the difference?



▶ Laser warning redesigned to fit within original-height case.

2001

Can you spot the difference?



▶ New LED display identifies each of four bands: X, K, Ka and laser.

1998

Can you spot the difference?



▶ Front and rear laser-warning added; requires taller case.

1997

Can you spot the difference?



▶ V1 debuts with radical new feature—the Radar Locator.

1992

Radar Ahead Radar Beside Radar Behind



* Answer: Nope, Junk-K Fighter is a software algorithm.

** Answer: Nope, but V1 owners sure know it's there.

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Fleet Files:

Here's how our other long-term vehicles are faring in their 40,000-mile trials:



▲ *Newcomer*

2016 CHEVROLET CAMARO SS

Arrival: Feb/2016
Miles: 5734 Observed mpg: 19

CHEVY'S CAMARO NOW COMES STANDARD with a turbo-charged 2.0-liter four, but a four-pot Camaro somehow seems wrong, like a UFC pillow fight. So we ordered ours proper, with a 455-hp V-8 and a six-speed manual, our preferred configuration when we named it a 10Bester last year.

Our 2SS trim arrived with the optional Magnetic Ride Control (\$1695), dual-mode performance exhaust (\$895), and MyLink audio system with navigation and an eight-inch touchscreen (\$495). We also opted for a low-gloss black finish on the standard 20-inch wheels (\$200).

All in, we're looking at a \$45,580 Camaro, one that vaporized the 60-mph milestone in 4.0 seconds in its first track visit. It also covered the quarter-mile in 12.8 seconds at 118 mph. For those who might blanch at the thought of a \$45,580 Camaro, know that its quarter-mile performance is only 0.1 second and 1 mph behind the last Corvette Stingray Z51 we tested. And the Camaro has back seats, even if they are largely useless. —*Josh Jacquot*

2016 Mazda MX-5 Miata

Arrival: Oct/2015
Miles: 11,804
Observed mpg: 31

After a few top-up months at the home office, our Ceramic Metallic roadster escaped to the warmth of Los Angeles. Now, the top is almost always down and our vitamin D levels are peaking. While fun-size dimensions are at the core of the Miata's charm, they also require compromises. The passenger's seat could use a couple more inches of rearward travel, and the cabin lacks storage space, so everything goes in the trunk. The Miata also has received a few scars where other drivers, apparently unable to see the low MX-5 when parking, decided to park by feel. We're ready for more sound insulation after five trips to San Diego in five weeks. On the freeway, the Miata doesn't seem any quieter with the top up than with it down. Yet another reason to let the sunshine in. —*Tony Quiroga*



2016 Ford Mustang GT Coupe

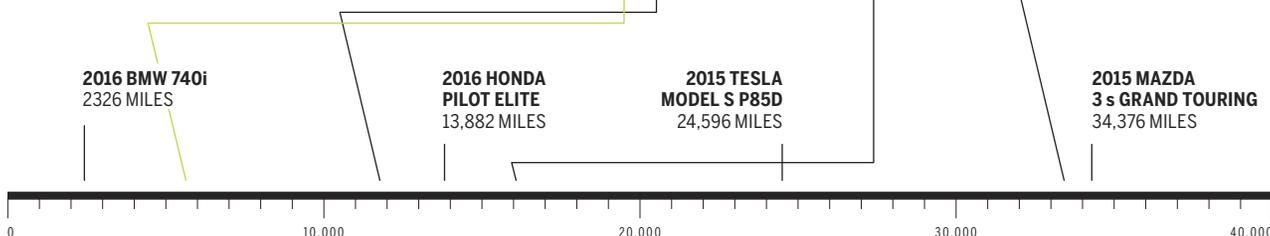
Arrival: Oct/2015
Miles: 16,013
Observed mpg: 20

Our Mustang GT handled the ravages of a Michigan winter surprisingly well, and thanks to regular travel throughout the Midwest, its fuel economy has increased to 20 mpg overall. While several drivers applaud the long-haul support of the Recaro sport seats, others complain about their aggressive side bolsters and limited adjustments. But there have been no qualms with the GT's melodious, 435-hp Coyote V-8—except that it's not loud enough. It's been a joy to exercise now that the weather has improved. Our pony-car spirits have been dampened only by one particularly nasty spring pothole, which drove the left-rear shock up through its top mount and damaged the fuel-filler tube, removing \$732 from our wallets. —*Mike Sutton*

2015 Volkswagen GTI

Arrival: Jan/2016
Miles: 33,549
Observed mpg: 29

After returning from its vacation with our left-coast editors, the GTI is finally showing a sign of age: a vibration in the driveline that crescendos at 70 mph. The Ontario, California, dealership that handled the 30K-mile service—\$74 for a basic lube—placed the blame on its winter tires. We're waiting until we refit the summer rubber to see if it was right. This small annoyance is dwarfed by the high mountain of praise that fills the GTI's logbook. Okay, there is a complaint about an iPhone connector that won't connect to a case-protected iPhone. We cope by using the USB connector instead. —*K.C. Colwell*





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		Tire Performance & Review													Total Miles Reported	
		1	2	3	4	5	6	7	8	9	10	11	12	13		
1	Michelin High-Performance All-Season	60%	7.7	8.6	8.3	8.8	9.1	9.1	7.3	6.6	5.7	9.0	9.0	9.3	290,306	
2	Continental Super Sport All-Season (95 Speed Rated)	9%	7.8	8.8	8.9	8.2	8.9	8.2	8.2	7.4	7.3	8.8	8.3	8.1	46,172,520	
3	Continental ExtremeContact (DWC)	9%	8.4	8.7	8.9	8.9	8.1	8.9	7.5	6.0	6.3	8.4	8.2	8.2	987,796	
4	Continental ExtremeContact (DWC) All-Season	9%	6.8	6.6	6.9	8.1	8.5	8.5	7.7	6.9	5.7	8.1	8.2	8.4	258,856	
5	Continental ExtremeContact (DWC) All-Season	9%	7.4	8.8	8.6	8.6	8.7	8.8	7.1	5.6	5.8	8.8	8.6	7.7	1,641,945	
6	Continental ExtremeContact (DWC)	8%	9.0	8.8	8.7	8.4	8.8	8.4	7.6	6.4	6.2	8.0	7.1	8.2	5,578,503	
7	Continental ExtremeContact (DWC) All-Season	9%	6.1	6.2	6.3	6.3	6.7	8.4	8.5	7.7	7.0	7.0	7.4	6.4	246,500	
8	Continental ExtremeContact (DWC) All-Season	8%	9.4	7.8	8.5	8.6	8.9	9.0	8.7	8.6	5.3	5.6	8.5	8.3	7.9	4,067,895
9	Continental ExtremeContact (DWC) All-Season	9%	7.7	8.3	8.3	8.6	8.8	8.6	8.7	5.3	5.7	8.4	8.2	7.7	23,158,180	
10	Continental ExtremeContact (DWC) All-Season	8%	8.7	8.0	8.1	8.8	8.8	8.8	7.1	6.2	6.1	8.0	7.4	7.3	8,581,424	
11	Continental ExtremeContact (DWC) All-Season	8%	7.2	8.8	8.9	9.0	9.2	9.3	6.1	4.7	4.6	8.3	7.8	7.5	1,856,329	
12	Continental ExtremeContact (DWC) All-Season	8%	6.8	8.8	8.8	8.8	9.0	8.9	6.0	4.8	4.7	8.0	7.8	8.1	3,861,040	
13	Continental ExtremeContact (DWC) All-Season	8%	7.4	7.7	7.8	8.1	8.5	8.1	6.4	5.3	5.4	8.1	7.9	7.3	40,058,066	



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'Line in the Sand

Honda doubles down on its revolutionary **Ridgeline**. *by Jared Gall*

▼
JUST BECAUSE A VEHICLE TURNED OUT to be a sales *Hindenburg* doesn't mean it was a bad idea. Or one that doesn't merit further development. The Honda Ridgeline, which made its debut in 2005, was a radical rethinking of the mid-size truck, a unibody revolution for the most proletarian of pickup segments. In 2008, after Toyota and GMC unveiled similar unibody-truck concepts just one month apart, GMC's then general manager told us that he expected the entire compact-truck market to go unibody. And yet, the bed-bearing Honda nabbed just 7 percent of mid-size-truck buyers over its nine-year run. In its worst year, 2011, the Ridgeline's market share slipped to just 3 percent. The other 97 percent of buyers weren't asking for reinvention, they just wanted a truck.

Maybe now, in this era of car-based SUVs, the mildly machismoed can be persuaded to take another look. The ride-quality chasm between the Ridgeline and

[+] Unparalleled ride, endless clever storage options.

[-] Below-average tow rating, minivan nose.

its competitors is so wide that medieval mapmakers would have scribbled "Here Be Dragons" in the general vicinity of GM, Nissan, and Toyota headquarters. The Honda delivers a ride that no live-axle, body-on-frame vehicle can manage. It's all lightness and composure, with carlike body control and smoothness. Impacts that would have a solid axle tossing occupants around register as brief, light shudders.

As for capability, the new Ridgeline's 1584-pound payload is one of the highest in the segment (e.g., Chevy Colorado/GMC Canyon, Nissan Frontier, Toyota Tacoma). While its 5000-pound maximum towing capacity is among the lowest, Honda's research suggests that just 6 percent of mid-size-truck buyers ever tow more than that.

2017 HONDA RIDGELINE

VEHICLE TYPE: front-engine, front- or all-wheel-drive, 5-passenger, 4-door pickup
BASE PRICE: \$30,375–\$43,770
ENGINE TYPE: SOHC 24-valve V-6, aluminum block and heads, direct fuel injection
DISPLACEMENT: 212 cu in, 3471 cc
POWER: 280 hp @ 6000 rpm
TORQUE: 262 lb-ft @ 4700 rpm
TRANSMISSION: 6-speed automatic
DIMENSIONS
WHEELBASE: 125.2 in
LENGTH: 210.0 in
WIDTH: 78.6 in
HEIGHT: 70.2–70.8 in
PASSENGER VOLUME: 110 cu ft
CURB WEIGHT: 4250–4500 lb
PERFORMANCE
(C/D EST)
ZERO TO 60 MPH: 6.4–6.7 sec
ZERO TO 100 MPH: 16.6–17.4 sec
1/4-MILE: 15.0–15.3 sec
TOP SPEED: 110 mph
FUEL ECONOMY
EPA COMBINED/CITY/HWY: 21–22/18–19/25–26 mpg

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To assuage the aesthetic concerns of those who really want to tow stuff someday but just haven't found the right opportunity, the rebooted Ridgeline looks like a regular pickup. Well, a regular pickup melded with a minivan. Honda representatives tell us that the previous generation's appearance is what dissuaded most shoppers, that the brutalist flying-buttress cab and sloping bed-sides visually shortened the bed. Even though it was competitively sized, most shoppers assumed it wouldn't suit their needs and looked elsewhere. Now, not only is the bed visually lengthened, it's also physically lengthened. Honda stretched it four more inches, to 64, longer than the short boxes on the crew-cab Colorado and Tacoma (it is, however, about 10 inches shorter than the available long beds on those trucks). And Honda's is the only truck in the class that can accommodate a four-by-eight-foot sheet of building material flat between the wheel wells.

Original Ridgeline ideas that carry over include the lockable underbed trunk and the dual-action tailgate that either drops or swings to the side. Honda ups the weirdness by making the bed into one gigantic speaker in top trim levels. It uses six exciters, which are small electric actuators capable of vibrating at thousands of oscillations per second. Mounted behind the bedsides, they act as speaker magnets that use the panels they're mounted to as cones. The upside

is that they're protected against water and impacts. The downside is the system's low-fi sound with nonexistent bass.

Which, if you have any friends who like techno, is not a downside at all. But for doing what one does with a truck bed—standing around it, leaning on it—it's a good means of reproducing country music. Honda expects that you'll use the bed's available 400-watt inverter to power a big-screen TV during tailgate parties, in which case your inebriated neighbors will surely be wowed. Just watch that they don't spill their beer on your TV.

tech highlight

KNUCKLE SANDWICH

Nearly every component in the Ridgeline's suspension is beefed up compared with its Pilot counterpart, from control arms and knuckles to struts and bearings. For the steering knuckle shown here, the Ridgeline gets a hollow-cast part that is stronger than the Pilot's I-beam piece, but nearly as light. The hub bearing is larger in both diameter and width to handle heavier loads.



Ridgeline vs. Pilot:



17%
Claimed increase in strength of the front suspension.



31%
Claimed increase in strength of the rear suspension.



The last of the bed's tricks is that it is constructed of dent- and scratch-resistant composite plastic, meaning you can toss whatever you want in the back and not worry. Honda proved its point by inviting us to attack the bed with a garden rake and then dumping a load of football-sized rocks into the bed from a tractor. By straining mightily on the rake, we were able to see the slightest lines in the bed finish, but the rocks left no marks of note.

The Ridgeline now looks a bit more like a conventional pickup—well, except maybe for the nose. The in-bed trunk, however, is delightfully unconventional.

While the Ridgeline's suspension is similar to the Pilot's, and therefore related to the suspension in the upcoming next-generation Odyssey minivan, nearly every major component is beefed up to handle pickup duty [see tech highlight]. Engineers tell us the front is 17 percent stronger than the Pilot's while the rear is engineered to handle loads 31 percent higher. The difference doesn't just manifest in the Ridgeline's greater workload ratings. On the road, where the Pilot wallows and feels a little sloppy, the Ridgeline's firmer bushing and damper tuning gives it a more controlled ride. As in the Pilot, the Ridgeline's soft brake pedal and light steering are a little too squishy, but in this class, vague controls are the norm from which only the well-handling Colorado/Canyon twins deviate.

Another critical difference between Pilot and Ridgeline is the transmission. In our experience, shifts from the Pilot's nine-speed vary in speed and smoothness as you climb through the ratios. The Ridgeline's six-speed, though, is consistently quick and seamless.

With 280 horsepower and 262 pound-feet of torque, the new 3.5-liter V-6 tops the outgoing engine by 30 horsepower and 15 pound-feet. It's smooth and unobtrusive, a perfectly acceptable if uninspiring engine for a mid-size pickup.

Honda predicts best-in-class acceleration, but we'll see. The Ridgeline is proof that "unibody" doesn't mean light as much as "sturdy" generally means heavy. Honda claims—and our experi-

ence bears out—that the Ridgeline is more rigid than either the Colorado or the Tacoma. But its 4500-pound curb weight is also greater. And while Honda claims best-in-class fuel economy, that's only true if your definition of "class" omits GM's gas and diesel four-cylinders. Front-drive Ridgelines are rated at 22 mpg combined with 19/26-mpg ratings, city/highway. All-wheel-drivers see 21 mpg combined and 18/25, city/highway.

As before, the Ridgeline's interior positively embarrasses the competition. It feels enormous, its lack of a frame allowing for a comfortable seating position and a tall, spacious cabin. The flip-up rear seat remains from the previous generation, opening up yet another yawning, weather-protected storage cavity when raised. The seat also hides up to 2.9 cubic feet of space, or enough for at least one golf bag, beneath seated passengers.

As with other Honda vehicles, there's an available tech package that, in addition to lane-keeping assist and blind-spot monitors, offers adaptive cruise control with forward-collision warning and automated emergency braking. Honda expects that the tech package, with the braking, will help it score a Top Safety Pick Plus rating from the IIHS, which would make it the only mid-size truck to do so.

But no matter how much tech Honda packs in, we're a long way from accepting the company's touchscreen infotainment system. The menu structure must have been designed by someone either vastly smarter or vastly less intelligent than us, because it simply does not make sense. There be the dragons.

The 2017 Ridgeline goes on sale this summer at a base price of \$30,375 for a front-drive RT. All-wheel drive is an \$1800 option on all but the top two trims, and a fully loaded Ridgeline will surpass \$40,000. At that point, as with all less-than-huge pickups, the question becomes why not just get a full-size truck? For us, it's a no-brainer, as no other pickup of any size is as refined and civilized as the Ridgeline. Here's to hoping that more Americans start giving a damn about civility.



TESTED

Dawn of the Bred

Rolls-Royce's new **Dawn** and the glamour of the mechanical. *—*by John Pearley Huffman

▼
THE ROLLS-ROYCE DAWN is most at home cruising the glittering boulevards of Palm Springs or Palm Beach, the Siriusly Sinatra channel permanently playing, and the driver wearing \$2600 Gucci crocodile loafers while contemplating how to cajole public financing for his new NFL stadium. Unlike, say, the similarly pricey Lamborghini Aventador, the Dawn can be driven and used every day. It clears curbs, there's some room in the trunk, there *is* a trunk, and it's easy to get in and out of. It also doesn't invite a race at every stoplight, though it may invite people of all races to spontaneously come up to the window and quote Bernie Sanders. Alas, first-world problems.

The Dawn earns its copious allocation of asphalt by adding mechanical substance and harmony to exquisite design and detail. It's not a basket of latter-day tricks; it's not compatible with Apple

[+] Character and power with everyday usability.
[-] Low cornering limits, a \$400,000 price.

CarPlay, and there's no onboard Wi-Fi. At \$402,300 as tested, including a \$2750 destination charge and a \$2100 gas-guzzler tax, the Dawn is slightly old school, like its future owners.

At a glance, the Dawn is a decapitated Wraith coupe, but Rolls says 80 percent of the body panels are unique to the new car. Top up, it has a spectacular raked profile, and a gorgeous sailing-sloop silhouette when the six-layer cloth top is down. With its recessed grille, it looks fantastic from the front whether you choose to keep the Flying Lady ornament deployed or, as is allowed by a function in the center-console screen, hidden away below a trapdoor. From the rear, well, the car is not quite as distinctively stately.

It rides on the same 122.5-inch wheelbase as the Wraith and is only slightly

tech highlight

BESPOKE, BUT QUIET

"It's a composite foam material," explains Terence Grogan, Rolls-Royce's product manager for North America, about one of the elements that hushes the Dawn down to a perpetual whisper. "It seals every weld seam, and it's injected into every hollow space. And it fills every open space. It's a proprietary material, and if I knew exactly what it was, I wouldn't tell you."

From the insulation covering the bottom of its hull to the four layers of material between the roof's interwoven canvas-and-rubber shell and cashmere-blend headliner, the Dawn is a convertible obsessively engineered for silence.

"Wherever you have hollow spaces you have resonance," Grogan explains, "so we fill those spaces with the injectable foam. Then we use composite padding on the underbody's flat spaces." In fact, after the basic body in white arrives from Germany at Rolls-Royce's plant in Goodwood, England, it is first painted and then immediately

sound insulated before the drivetrain, suspension, and interior go in. "The final sound-deadening process is one of the last things we do," he continues. Final tuning is specific to each car and includes relocating foam and adding or subtracting pieces as necessary.

The top material itself is held in tension when the roof is up to keep it from developing folds or ripples that may add noise. And it's assembled using French seams that place the joined

materials and stitching inside and minimize breakup of the airflow. Even at a 70-mph cruise, the Dawn we tested produced only 61 decibels of sound inside the cabin. That's quieter than a Mercedes-Benz S-class sedan.

And even though the Dawn's 184-pound roof is actually larger than a Phantom Drophead's, Grogan says, it will fold down and store in a space smaller than the top of a BMW 2-series convertible. *—JPH*

2016 ROLLS-ROYCE DAWN

VEHICLE TYPE: front-engine, rear-wheel-drive, 4-passenger, 2-door convertible
PRICE AS TESTED: \$402,300
BASE PRICE: \$339,850
ENGINE TYPE: twin-turbocharged and intercooled DOHC 48-valve V-12, aluminum block and heads, direct fuel injection
DISPLACEMENT: 402 cu in, 6592 cc
POWER: 563 hp @ 5250 rpm
TORQUE: 575 lb-ft @ 1500 rpm
TRANSMISSION: 8-speed automatic
DIMENSIONS
WHEELBASE: 122.5 in
LENGTH: 208.5 in
WIDTH: 76.7 in
HEIGHT: 59.1 in
PASSENGER VOLUME: 100 cu ft
TRUNK VOLUME (TOP DOWN/UP): 9/10 cu ft
CURB WEIGHT: 5776 lb

C/D TEST RESULTS

ZERO TO 60 MPH: 4.3 sec
ZERO TO 100 MPH: 9.9 sec
ZERO TO 150 MPH: 24.1 sec
ROLLING START, 5–60 MPH: 5.1 sec
1/4-MILE: 12.8 sec @ 114 mph
TOP SPEED (MFR'S EST): 155 mph
BRAKING, 70–0 MPH: 162 ft
ROADHOLDING, 300-FT-DIA SKIDPAD: 0.83 g
FUEL ECONOMY
EPA COMBINED/CITY/HWY: 14/12/19 mpg
C/D OBSERVED: 15 mpg

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longer overall. The pair shares basic suspension, drivetrain, and structural elements, with the core engineering derived from a previous-generation BMW 7-series. From a performance standpoint, the difference is that the hardtop Wraith is about 400 pounds lighter and pushes its mass around with 624 horsepower from its BMW-built twin-turbo 6.6-liter V-12. The 5776-pound Dawn's similar V-12 is tuned to just 563 horsepower.

The Dawn is enormous, but more than a foot shorter overall than the discontinued Phantom Drophead Coupé it effectively replaces. In compensation, the Dawn is more graceful, more at ease in traffic, and less likely to goad the peasantry toward fiery insurrection. It's also surprisingly roomier than the Coupé.

Of course the Dawn's interior uses leather from cows apparently raised on a diet of butter, and the stitching is exquisite. The glossy wood trim chosen for our test car was perfectly matched. The simple instrumentation, which uses what look like tiny sterling-silver sugar spoons for pointers, includes a "Power Reserve" gauge in lieu of a tachometer. There's room for four full-size people to repose in comfort.

Enter through the massive rear-hinged, power-closing doors, and the Dawn seems almost human scale. It's tough to tell which switches are plastic and which are metal, but all work with straightforward ease. Even the "Spirit of Ecstasy Rotary Controller" that navigates through the menus on the 10.3-inch LED screen operates perilously close to intuitively, no doubt because with just a few changes to the graphics, it's actually BMW's infotainment system. Our test car had the optional radar-based cruise control and lane-departure warning aboard; blind-spot monitoring is not available on the Dawn.

A sanguine harp strum warns you that the V-12 is about to purr to life, and the transmission engages via a thin wand on the steering column. Using GPS-gathered

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data to optimize its shift points, the ZF eight-speed transmission shifts nearly undetected. Yet, despite such utter tranquility, this is an almost-three-ton convertible that whooshes to 60 mph in 4.3 seconds and consumes the quarter-mile in an astonishing 12.8 seconds at 114 mph.

There's not much steering feel through the oversize wheel, but the suspension tuning is perfect. This isn't a car that wafts or glides over the road, but one that confidently devours asphalt as if it were a ribbon of Beluga caviar. The Dawn may or may not have the stiffest production convertible structure yet, but nothing else offers such a magnificent ride—secure, serene, and controlled—over virtually any surface. However, it will push its 255/40R-21 Continental ContiSportContact5 front tires if hustled indiscreetly, and the engine doesn't respond quickly enough to offset that with power. So don't do that. The skidpad orbit was a modest 0.83 g, and the massive brakes hauled the Dawn from 70 mph in a fairly phenomenal 162 feet.

"In the world of Rolls-Royce, day-to-day mathematical norms don't always apply," says Rolls' director of design, Giles Taylor. "That's why I say in the case of the new Rolls-Royce Dawn, 2+2 does not equal 4." This may be smart marketing, a pleasant fantasy, or simple lunacy, but it's the bad math. And it misses the best thing about current Rollers, which is that they drive brilliantly in a world where two plus two always equals four. With interest.

Gone are the days when owners of megabuck British land yachts had to make excuses for their cars' outdated technology and subpar performance.



Remember the Titan

Launched as a diesel, Nissan's tweener truck now comes with gas power, costs less.

by Andrew Wendler

In an attempt to make its pickup relevant, Nissan took a big chance with the Titan XD. It flouted the industry's traditional duty-rating caste system and instead wedged the truck into the space it claims exists between half- and three-quarter-ton pickups. Leading with a Cummins diesel V-8 as the sole powerplant did little to quell the quirk factor. Now, the first XDs powered by Nissan's smoother and more powerful 5.6-liter V-8 gasoline engine are hitting the streets. Dubbed Endurance, the Tennessee-built 5.6 is a heavily revised version of the previous gas V-8. Featuring more than 150 new and unique parts and updates—including direct fuel injection, variable valve timing, and a higher compression ratio of 11.2:1 (versus 9.8:1 for the outgoing 5.6-liter)—the new V-8 produces 390 horsepower and 401 pound-feet of twist, increases of 73 and 16, respectively. Not surprisingly, this Titan drives like a truck, albeit a quiet one. Teamed with a seven-speed automatic, the updated V-8 is markedly smoother and quieter than before. The steering is slow, but there's an on-center valley that makes long, straight interstate stretches disappear as if the truck were on autopilot. Independent of trim level, going gas saves five large over the diesel. And given the truck's similar capability, that's a good start on relevance.

2016 NISSAN TITAN XD

VEHICLE TYPE: front-engine, rear- or rear/4-wheel-drive, 5- or 6-passenger, 4-door pickup

BASE PRICE: \$36,485–\$56,715

ENGINE TYPE: DOHC 32-valve V-8, aluminum block and heads, direct fuel injection

DISPLACEMENT: 339 cu in, 5552 cc

POWER: 390 hp @ 5800 rpm

TORQUE: 401 lb-ft @ 4000 rpm

TRANSMISSION: 7-speed automatic with manual shifting mode

DIMENSIONS

WHEELBASE: 151.6 in

LENGTH: 242.7–243.6 in

WIDTH: 79.5–80.7 in

HEIGHT: 78.0–78.8 in

PASSENGER VOLUME: 120 cu ft

CURB WEIGHT: 6000–6800 lb

PERFORMANCE (C/D EST)

ZERO TO 60 MPH: 6.6–7.3 sec

ZERO TO 100 MPH: 21.5–23.5 sec

1/4-MILE: 15.0–15.6 sec

TOP SPEED: 105 mph

FUEL ECONOMY COMBINED/CITY/HWY: N/A

Weights and measures: Titans gas and diesel, compared

MAXIMUM PAYLOAD RATINGS:

Diesel: 2091 lb

Gas: 2594 lb

MAXIMUM TOW RATINGS:

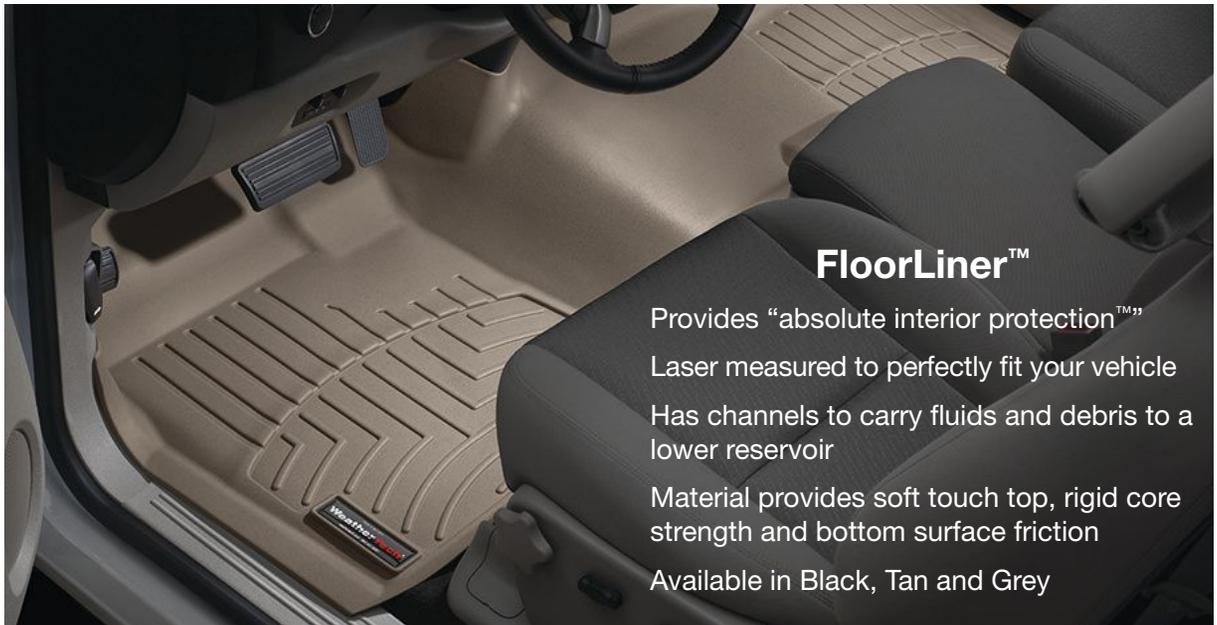
Diesel: 12,314 lb

Gas: 11,270 lb



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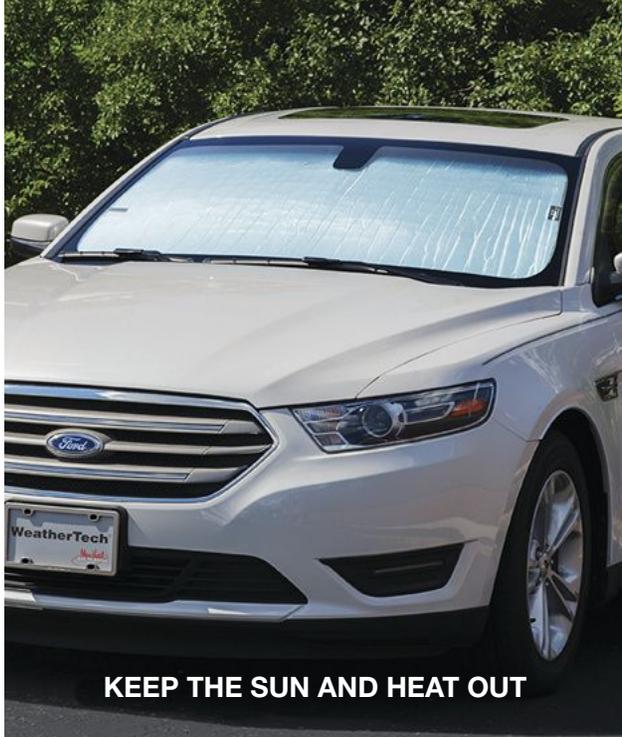
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TESTED

Lordy, Lordy

The Hyundai **Elantra** hits 40. As in mpg. For real this time. *—by Jeff Sabatini*

▼ **IN THE SEEMINGLY** interminable wake of the Volkswagen Dieselpgate scandal, there is only one true beneficiary: Hyundai. VW has helped us forget that in 2014 the Korean company's U.S. outposts were assessed the single largest fine in the history of the Clean Air Act. Hyundai and Kia overstated the fuel economy of a combined 1.2 million vehicles, costing the sibling rivals \$100 million in penalties plus the forfeiture of \$200 million in greenhouse-gas-emission credits. Dealers are still providing annual cash reimbursement to owners of affected vehicles, including the previous-generation Elantra, which was infamously promoted as able to achieve 40 mpg in highway driving. After the EPA bust, Hyundai restated the Elantra's fuel economy, downgrading its highway rating to 38 mpg.

We ponder all this now because Hyundai is back with a new Elantra for 2017, and a new model, the Eco, which again boasts a 40-mpg EPA highway rating. In our first two fill-ups of the new car, we calculated 42 and then 43 mpg. Impressed, we pitted the Eco against a regular Elantra Limited on a mixture of highways, twisty back roads, and city streets. The Eco returned 42 mpg in this exercise, for a 6-mpg margin of victory. When we totaled all the Elantra Eco's miles over the course of our testing, we actually beat its EPA combined rating of 35 by 3 mpg.

The Eco's miserly prowess is derived mainly from its 1.4-liter turbocharged four-cylinder engine. It makes just 128 horsepower—19 less than the naturally aspirated 2.0-liter in other Elantras—but remedies that deficiency with an extra 24 pound-feet of torque. The 1.4 hits its torque plateau at just 1400 rpm, when its 156 pound-feet delivers a swell of acceleration. It's enough to make the Eco half a second quicker to 60 mph than other Elantras, a welcome win-win that may better justify the upcharge than any projected savings at

[+] Quiet and quick turbo engine, mpg exceeds expectations.
[-] Hinky dual-clutch trans, vague steering.

the gas pump. The paltry \$400 extra you'll pay for an Eco over a similarly optioned Elantra SE will take years to recoup, at least as long as fuel prices remain low.

Another significant mechanical difference between the Eco and the rest of the Elantra lineup is its transmission, a seven-speed dual-clutch automatic that stands in for the conventional six-speed automatic. In this application, however, the dual-clutch comes from the frugal branch of the gearbox tree rather than the sporty one that bears fruit like paddle shifters and launch control. While the transmission shifts quickly enough, it does sometimes falter at low speeds. This often leads to the car leaping rather than creeping forward when you've let off the brake from a stop.

In every other way, the Eco is identical to the rest of the Elantra models, which is mostly a good thing. It feels just as solid and the cabin is even quieter than the others, the turbocharger providing an extra muffling effect. It handles with the same composure, while its steering has the same on-center dead spot. And the Eco has the same handsome styling, though its grille seems borrowed from another carmaker's parts bin.

But even if the Eco gets mistaken for a Ford or a Subaru, it won't be confused with the old Elantra. This one delivers on the promise of its badge.

2017 HYUNDAI ELANTRA ECO

VEHICLE TYPE: front-engine, front-wheel-drive, 5-passenger, 4-door sedan

PRICE AS TESTED: \$21,610

BASE PRICE: \$21,485

ENGINE TYPE: turbocharged and intercooled DOHC 16-valve inline-4, aluminum block and head, direct fuel injection

DISPLACEMENT: 83 cu in, 1353 cc

POWER: 128 hp @ 5500 rpm

TORQUE: 156 lb-ft @ 1400 rpm

TRANSMISSION: 7-speed dual-clutch automatic with manual shifting mode

DIMENSIONS

WHEELBASE: 106.3 in

LENGTH: 179.9 in

WIDTH: 70.9 in

HEIGHT: 56.5 in

PASSENGER VOLUME: 96 cu ft

TRUNK VOLUME: 14 cu ft

CURB WEIGHT: 2854 lb

C/D TEST RESULTS

ZERO TO 60 MPH: 7.8 sec

ZERO TO 100 MPH: 21.9 sec

ZERO TO 110 MPH: 29.0 sec

ROLLING START, 5-60 MPH: 8.4 sec

1/4-MILE: 16.2 sec @ 87 mph

TOP SPEED (GOVERNOR LIMITED): 120 mph

BRAKING, 70-0 MPH: 173 ft

ROADHOLDING, 300-FT-DIA SKIDPAD: 0.80 g

FUEL ECONOMY

EPA COMBINED/CITY/HWY: 35/32/40 mpg

C/D OBSERVED: 38 mpg

tale of the tape

ELANTRAFICATION

■ ELANTRA ECO
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HORSEPOWER:

128 hp

147 hp

TORQUE:

156 lb-ft

132 lb-ft

CURB WEIGHT:

2854 lb

2914 lb

ZERO TO 60 MPH:

7.8 sec

8.3 sec

LATERAL ACCELERATION, 300-FT SKIDPAD:

0.80 g

0.84 g

C/D-OBSERVED FUEL ECONOMY, 180-MILE DRIVE:

42 mpg

36 mpg



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Weight Watcher

The revamped 2017 GMC Acadia is more right-sized than downsized. *—by Mike Sutton*

▼ **THE OUTGOING GMC ACADIA**—along with its Lambda-platform siblings, the Buick Enclave and Chevrolet Traverse—may have been supersized beyond necessity. And after 10 years on the market with only modest changes, GMC's family truckster is past due for a wholesale update. While the redesigned 2017 Acadia may appear to be just a sleeker, not-quite-as-large version of the old model, it's significantly lighter and an altogether better three-row crossover.

Sharing its new Chi architecture with the five-seat Cadillac XT5, the GMC arrives with a wheelbase that's 6.4 inches shorter than its predecessor's. Length is trimmed by 7.2 inches and it's 3.5 inches narrower, so overall that's some serious girth reduction. The smaller footprint should account for a significant weight loss. GMC claims it to be as much as 700 pounds, aided by a greater proportion of high-strength steel and lightweight sound insulation.

[+] Less mass, solid three-row package, composed ride and handling.
[-] Too much chrome for some, pricey with extras.

While the Acadia still weighs more than two tons, the diet pays off in an SUV that's more awake from the driver's seat, both in city traffic and over undulating country two-lanes. Less mass helps the Acadia stop with greater stability, accelerate more assertively, and change direction with improved control. In other words, it's no longer a pig, and it's a better match for other suburban limos such as the Honda Pilot and the new Mazda CX-9 [see page 064].

The effort put into the dynamic details is obvious from behind the wheel; the brake pedal is firm and easy to modulate, and the electrically assisted helm feels precise and nicely weighted. A new terrain-selector dial on the center console further adjusts the steering, throttle, transmission, and drive-train settings for towing and off-road modes. GMC also saw fit to include a sport setting, which mostly just makes the suspension unnecessarily firm on the models we drove with the optional \$1200 adjustable dampers. The ride is generally all-day pleasant, though, even on the optional 20-inch wheels (18s are standard).

The Acadia's newfound lightness allows a four-cylinder to serve as its base powerplant for the first time. As in the GMC Canyon pickup, this 2.5-liter four-banger—here

2017 GMC ACADIA

VEHICLE TYPE: front-engine; front- or all-wheel-drive; 5-, 6-, or 7-passenger; 4-door hatchback
BASE PRICE: \$29,995–\$48,240
ENGINES: DOHC 16-valve 2.5-liter inline-4, 194 hp, 190 lb-ft; DOHC 24-valve 3.6-liter V-6, 310 hp, 271 lb-ft
TRANSMISSION: 6-speed automatic with manual shifting mode
DIMENSIONS
WHEELBASE: 112.5 in
LENGTH: 193.6 in
WIDTH: 75.4 in
HEIGHT: 68.7 in
PASSENGER VOLUME: 143 cu ft
CARGO VOLUME: 13 cu ft
CURB WEIGHT: 4000–4400 lb
PERFORMANCE (C/D EST)
ZERO TO 60 MPH: 6.8–8.8 sec
ZERO TO 100 MPH: 17.8–19.7 sec
1/4-MILE: 15.0–17.6 sec
TOP SPEED: 115 mph
FUEL ECONOMY
EPA COMBINED/CITY/HWY: 20–23/18–21/25–26 mpg

Drivelines



regular setup. But at least a seven-inch center touchscreen with Android Auto, Apple CarPlay, and Wi-Fi is standard on all trims.

Although cargo volume behind the front row drops from 116 cubic feet to 79, the second and third rows both fold flat with little fuss. Second-row captain's chairs are available in place of the standard split-folding middle bench, and both setups recline and slide. The GMC's third row is one of the better ones out there, with surprisingly easy access and enough space to accommodate two actual adults in relative comfort. The All Terrain is the only five-seat version, its third row replaced by a flat load surface and additional underfloor storage.

Being a family hauler, the Acadia can of course be had with GM's latest suite of safety helpers and watchdogs, as well as standard three-zone climate controls, five USB ports, and a 110-volt outlet for the second row. And because, sadly, forgetting to remove children from cars is a real thing, the Acadia also features an industry-first rear-seat reminder that flashes and sounds a warning to check the back rows when shutting down the vehicle. To prevent annoyed solo drivers from just deactivating it, which is possible, the system only works if the rear doors are opened within 10 minutes of the vehicle being started.

Pricing starts at \$29,995 for the front-wheel-drive SL model, but you'll have to spend at least \$35,375 for the SLE to get all-wheel drive. The top-of-the-line all-wheel-drive Denali's \$48,240 price includes even

making 194 horsepower versus 200 in the truck—is relatively smooth and hushed in operation. But the optional 310-hp 3.6-liter V-6 (standard on the Denali and All Terrain models) is worth the \$1095 upcharge. The 3.6 is largely the same mill found in the excellent new Chevy Camaro, and its refined character and 271 pound-feet of torque better suit the Acadia than does the four-cylinder. Both engines are backed by smooth-shifting six-speed automatic transmissions and are available with all-wheel drive for \$2000 extra. The \$41,925 All Terrain model uses special hardware to distribute torque across the rear axle [see tech highlight].

The Acadia's EPA combined rating of 20 mpg for all-wheel-drive V-6 models is 3 mpg better than the outgoing generation's, and only 3 mpg lower than the four-cylinder's 23 mpg. Less mass also should make the GMC's acceleration more competitive within its class, with V-6 examples now likely to hit 60 mph in the high-six-second range and four-cylinders taking closer to nine seconds.

At a glance, the Acadia's proportions are closer to those of the smaller GMC Terrain, only better managed. But it's hard to love the new ovoid grille, and GMC branding means lots of chrome adorns the body. The darker-trimmed All Terrain version is the alternative for the less flamboyant.

The Acadia's interior is not as flashy as its exterior, with a sensible control layout, brushed-aluminum trim, and real wood inserts that manage not to look like real wood on Denali models. We wish every model featured the Denali's larger display in its instrument cluster, which can be configured with a greater variety of trip, navigation, and audio information than the

The trimmer, smaller Acadia is more nimble and attractive than the vehicle it replaces. The loaded Denali shown here is for chrome fetishists only.

more chrome, unique wheels, and the potential to push the sticker beyond 50 grand with options.

Considering the time GMC took to redo the Acadia, it's not surprising that this new version is better than the original. Yet, even within this ultracompetitive segment, the 2017 model's mix of packaging and overall performance makes a compelling argument. It also proves that bigger isn't always better.

tech highlight

ACTIVE TWIN CLUTCH AWD

The 2017 GMC Acadia will never be mistaken for a trail rig, yet it does gain some capability off the beaten path with the new All Terrain model's standard Active Twin Clutch (ATC) all-wheel-drive system. Comprising a pair of electronically controlled clutches in place of a rear differential, ATC can partially or fully engage each rear wheel independently to maximize traction on slippery surfaces. While it can't overdrive the rear wheels as in a true torque-vectoring setup, it can deliver all the rear axle's torque to the wheel with the most grip. Think of it as an advanced limited-slip diff with control integrated into the Acadia's terrain-selector dial. —MS



Eight Is Enough

The 2016 Argo LX 8x8 is a triple-diff amphibian.

by John Pearley Huffman

▼
THE CANADIAN-MADE Argo LX 8x8 isn't great at any one thing, but it's good enough at so many things that greatness seems irrelevant. On dirt trails, it confidently bounces along on its wheels like a buckboard wagon pulled by eight sucrose-snorting horses. On pavement, it corners with such suddenness that it feels as if it's dodging turtle shells in Super Mario Kart. It will bound across sand, push through snow, scramble over steep and soggy berms, and, if driven into a lake, it will swim a slow, desperate dog paddle.

Grab the handlebar and twist the throttle grip, and the LX takes a quick set, rapidly accelerating to its 25-mph terminal velocity. Give the handlebar a slight nudge, and the LX darts as the inside wheels slow while the outside wheels continue churning. Its stability shouldn't be taken for granted, but with acclimation, it's easy to pilot precisely.

At top speed, the Argo LX is *Mr. Toad's Wild Ride*. It is eight sticky contact patches bounding through a birthday-party bounce house. The LX is 124 inches long, or 27 inches shorter than a Mini Cooper, cramming four tires per side into a 78.9-inch wheelbase. Running 9-inch bead-lock wheels, those squishy 12-inch-wide Argo-



[+] Massive traction, huge utility, and big fun.
[-] Slow swimmer, not street legal.

specific tires are inflated to only 1.7 psi. The tires make up the entire suspension system, and their low pressure ensures that each conforms to the terrain for maximum grip. Under the \$27,295 LX's epoxy-acrylic coating is a steel tube frame with a 747-cc Kohler V-twin engine rated at 30 horsepower. The LX's big advance over most previous multiwheeled amphibians is its dual-range, triple-differential steering transmission [see tech highlight] that allows for smoother cornering. Mediating between the engine and the steering transmission is a centrifugal-clutch transmission of the type more commonly found in ATVs. Each bank of four tires is driven by a common chain, so all four churn at the same speed.

With a payload of up to 1000 pounds and room for six people, the LX is a fine tool for managing a large chunk of muddy property or hunting out remote fishing spots. It's not street legal, but it's not much of a commuter anyway. It will manage in calm water, but forget about any chop. And if it's overloaded, as one was at the Texas Hill Country press launch, it will sink.

Compared with a side-by-side UTV, the Argo LX is more stable but not as quick. And it won't carry as much as a 4x4 pickup, but trucks don't swim at all. Compromises are rarely this entertaining. ■

2016 ARGO LX 8X8

VEHICLE TYPE: front-engine, 8-wheel-drive, 4- or 6-passenger, 0-door amphibious UTV
BASE PRICE: \$27,295
ENGINE TYPE: pushrod 4-valve V-2, aluminum block and heads, port fuel injection
DISPLACEMENT: 46 cu in, 747 cc
POWER: 30 hp @ 3600 rpm
TORQUE: 45 lb-ft @ 3200 rpm
TRANSMISSION: continuously variable automatic
DIMENSIONS
WHEELBASE: 78.9 in
LENGTH: 124.0 in
WIDTH: 60.0 in
HEIGHT: 47.0 in
WEIGHT: 1350 lb
PERFORMANCE (MFR'S EST)
TOP SPEED ON LAND: 25 mph
TOP SPEED ON WATER: 3 mph

tech highlight

BEYOND SKID STEER

Six- and eight-wheeled ATVs have traditionally turned via unsophisticated skid-steering, in which mechanical brakes stopped the wheels on one side while torque flowed to the other. The Argo LX refines that idea by using three differ-

entials in conjunction with the brakes to decelerate one bank of wheels and accelerate the other.

"In high range, it doesn't stop the wheels on one side. Rather, at full steering lock, it slows the inner wheels down by a three-to-one ratio," explains Peter Visscher, Argo's chief technology officer. "So instead of doing a sharp pointed turn, it actually does a sweeping turn. There are some steering brakes in there, but

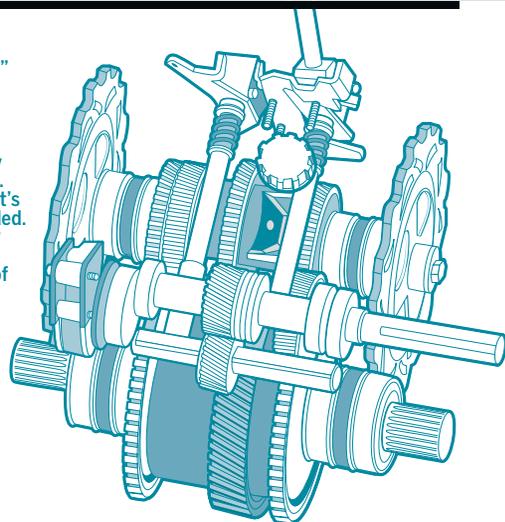
they're not tied directly to the output shafts."

There's still a disc brake on each bank to initiate the turn, and the difference in bank-to-bank wheel speed will vary with steering input, but the system generates less heat than a fully brake-dependent system while cornering more comfortably. It's still a sudden sensation, but relatively gentler because the Argo doesn't have to slow abruptly to turn. "It's more

user-friendly than what we used to do," adds Visscher.

In low range, the brakes will stop the inside tires and the Argo will practically rotate around itself. And sometimes that's exactly what's needed.

The next step for Argo: Create a fully electronic version of this system that doesn't depend on brakes to steer.
—JPH



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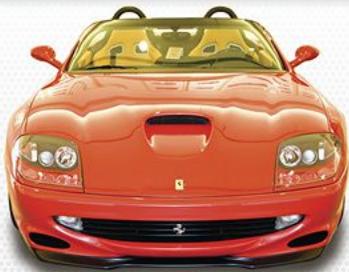
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What I'd Do Differently

Chip Foose, 52

In 2015, the hot-rod designer whose cars have won eight AMBR awards and four Detroit Autorama Ridler awards finished his ninth and final season of *Overhaulin'*.

► interview by JOHN PEARLEY HUFFMAN



C/D: So which is better: the America's Most Beautiful Roadster (AMBR) or the Ridler award?

CF: Boy, that's getting political, isn't it? The difficult thing with the AMBR award right now is that there's no target on the wall about what you need to build. The way they've done the judging, your guess is as good as anybody's about what you need to build. It's not based on difficulty to build. It's a choice now, not a judged trophy. As a builder you're thinking, "We've got to push the envelope," and that's not what it's about now.

■ What is the pitfall of licensing your name?

□ You're not in control of what someone else is doing to your reputation.

■ Unique Performance in Texas,

which collapsed in 2007, had a license to build '69 Camaros under your name . . .

□ How did you know I was thinking of them? That was a nightmare. All I did was a drawing, and I was supposed to collect a royalty when he [Doug Hasty] sold or delivered a car. When he didn't deliver cars, people came after me. I can say that just about everything I made on *Overhaulin'* was spent there. Just protecting us. Legal bills.

■ Have you learned how to protect yourself from that?

□ Well, I married an attorney. She helped us, and we got through it.

■ Are you going into the shop every day? Or are you spending more time on designs?

□ That's the great thing about this job. My day is different every single day. I may stay home—I have a

studio at home. Last night, I was in the shop until one in the morning fabricating on Wes Rydell's '39 Cadillac that we're building. It's going to be very stately. It will look like an original Cadillac until you look underneath.

■ Is there something you'd like to build?

□ What has really been on my mind a lot is that I want to build a Duesenberg. I would love to find a chassis and design and build my own body. That's how they used to build them back in the '20s and the '30s.

■ Could you hot-rod something like a Tesla?

□ I don't think it's impossible. I don't care what the underneath is as long as I get to be creative and build something no one has ever seen before.

■ With TV exposure comes fame. How is that to deal with?

□ The biggest downfall about the success of *Overhaulin'* is that I just can't take my son and enjoy a car show. It's not fun for him to stand there when everyone wants to take a picture or get an autograph. Which I don't mind doing, but it breaks my heart that some of my favorite memories with my dad are walking around shows and looking at all these different cars and talking about them. I'm sad that I don't get to share those moments with my son and share the passion that we have for cars.

■ What's the upside to fame and fortune?

□ I wouldn't say that I've made a fortune, but the upside is that a lot of people want to work with you.

■ What do you think of things like the Porsche 911 Reimagined by Singer?

□ It's great that they've made a business out of that. It makes it really easy to be repetitive. I know I would get bored being repetitive. I want to do something different and new every time.

■ Are there cars you look at and think shouldn't be touched?

□ There are a lot of cars that don't need to be messed with. I don't know if you saw the Pantera I just finished. That's a car I thought if anybody messes with it, they try to make it like a Ricky Racer car. And I thought, just make it with beautiful wheels, bring the car down, but leave the body alone.

■ Are people afraid to cut into old cars now?

□ Time has become the expense. It used to be that the parts were expensive and the labor was always affordable. It's at the point now that the labor is the expensive part and there's less creativity. The biggest crime happening in America is the fact that they've pulled all these shop classes out of schools. Kids today, their dream isn't to build something, it's to buy something.

■ Ultimately, was being on *Overhaulin'* a net positive?

□ It was definitely a positive. I really enjoyed doing that for people. And it's more fun to do it for people who could never imagine having something like this in their life. The first five years that we filmed, we did every one of those cars in eight days or less. We did 29 cars in nine months. That was me not sleeping for an average of 24 days a month. It was a complete burnout by the end of the third season. Then we were off for four years. When they asked me if I wanted to come back and do the show again, I said I'd love to. But give me three weeks per car. What would I do differently? I'd never agree to the eight days or less.

■ What would you still like to do?

□ If I knew what was happening in the future, I'd be doing it now. ■

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