

Home Science Technology Automotive Adventure



Best Gear & Gadgets

16-Page Pullout! p.29

**TOP
10
CARS
OF THE YEAR**
p.46



Since 1902 PopularMechanics.com Volume 189 No. 12

110TH ANNIVERSARY SPECIAL

ISSUE

Popular Mechanics

The Future

110 Predictions
For the Next 110 Years

SELF-DRIVING CARS

CLONING
EXTINCT
ANIMALS

BIONIC
BODIES

"TERMINATOR" VISION

HOLOGRAPHIC TV

RETURNING BY 2030:
SUPERSONIC JET
TRAVEL

YOU
WILL LIVE
ON MARS
(IF YOU WANT TO)

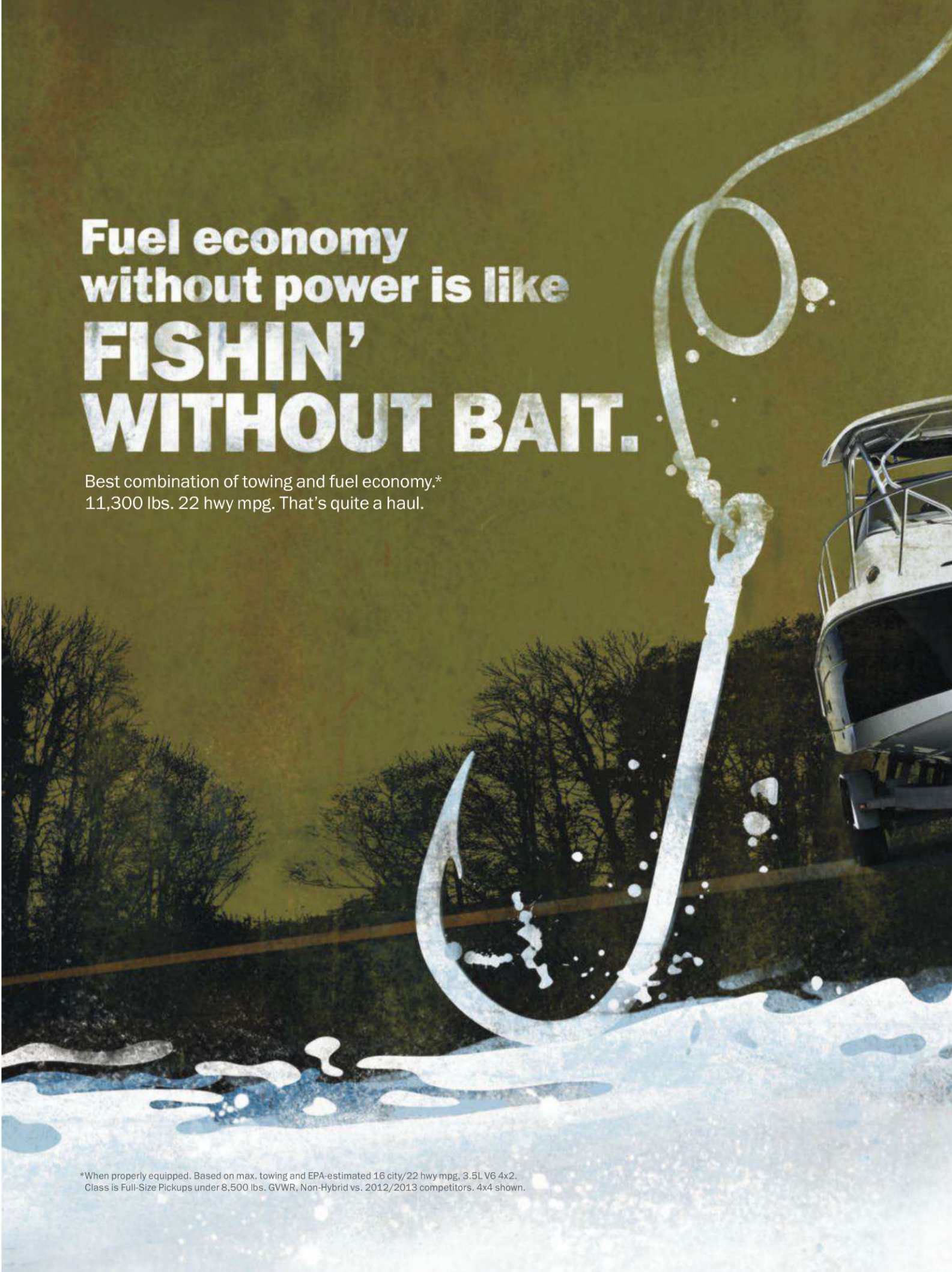
SUPERCOMPUTER FITS
IN YOUR POCKET!

SELF-CLEANING
CLOTHES

ALIEN LIFE
DISCOVERED

All This and More Starts on p.74

12.12



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PopularMechanics

IGNITION

The future is uncertain, but don't worry, a few things will never change.

12.12

INSIDE

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Stuck in the Ice As the Arctic opens up, the U.S. icebreaking fleet lags behind..... **68**

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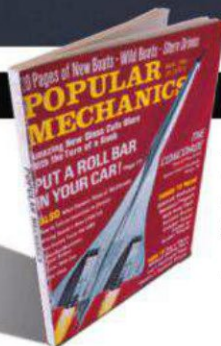
The World of Tomorrow What will the next 110 years hold? A special PopMech feature takes an expansive look into the future. BY THE EDITORS; ESSAY BY JAMES B. MEIGS..... **74**

Around the Corner Ten-year forecast: Hello to smart homes and robotic trainers, and so long to passwords and traffic jams **77**

On the Horizon Within 50 years the Super Bowl will play out on your carpet, and supercomputers will shrink to sugar-cube size..... **87**

The Great Beyond By 2122, homes will grow from trees, implants will reverse paralysis, and passenger planes will fly sans pilots **91**

ON THE COVER



Sleek, soaring jets have long symbolized the promise of the future. Taking a cue from our March 1968 Concorde issue, this month's cover features its spiritual successor: the Supersonic Green Machine. Developed by Lockheed Martin and NASA, the concept could be efficiently flying at Mach 1.6 as early as 2030.

PopularMechanics

W

weekend

23 Pages of DIY

**96. Home**

Technology you can install today, and how it will shape the home of tomorrow.

Early Adopter Playground classic: knock hockey.

Tool Test Cordless jigsaws.

Home Clinic The easy fix for faulty mini lights.

**112. Science**

Grab your computer and join the search for E.T. with SETILive.

**114. Tech**

All hard drives die: How to make your data survive for a century.

Digital Clinic Ways to resell old gadgets.

**128. Auto**

Collectible cars aren't all performance monsters. Here, 10 unexpected classics.

Car Clinic Demystifying the inertia-roll seatbelt.

IGNITION

?#@*8%!

What You Said

(ABOUT OUR OCTOBER ISSUE AND MORE)

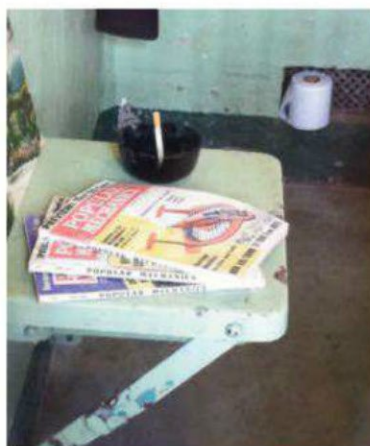


We read all of your comments, tweets, and letters. Our egos are very fragile, so please be kind.

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TALK TO US

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A reader spotted these vintage PMs in the replicated cell house on Alcatraz Island near San Francisco.

In the October feature "Detroit 2025," writer Bill Morris laid out our vision for a revitalized Motor City and drew a passionate response. "Detroit's renewal will be an uphill battle, but it is possible," James Courtney commented via Facebook. The story described a comeback based on innovative urban planning, infrastructural upgrades, and economic forces other than the auto industry as we knew it. "The future city you describe is much more sustainable than Detroit of yesteryear," Courtney added. Jim Grant of Rochester

Hills, Mich., felt that poor local government would thwart a recovery. "A city that is incapable of helping itself while steadfastly refusing help from others has no chance of making the advancements you suggest," he wrote. Dave Scott of Billings, Mont., agreed—with a twist. "Your humorous fairy tale about Detroit's future glory has left me wondering what PM's agenda really is," he wrote. No agenda here, Dave: We just want to present compelling stories. ● Readers enjoyed our "Field Guide to Junkyards" (DIY Auto, September). "My dad made sure I knew my way around a junkyard before I left home—and we've had 'continuing ed' ever since," Aqeelah Billingslea commented via Facebook. ● Eagle Scout candidate David Morgan of Troop 193 in Easton, Mass., used our online plans to make picnic tables for his town pool. "The designs worked great!" he wrote. "They were simple for Scouts to build and seem sturdy enough to last for years." Check out more plans at popularmechanics.com/how-to-plans.

COMPLAINTS DEPARTMENT

The slang term "thump junkies" ("For Fireworks Thump Junkies, Too Loud Is Never Loud Enough," popmech.com) is appalling to me as a pyrotechnic technician and hobbyist. Stop insulting the people trying to save the fireworks industry. **DENNIS PRICE**



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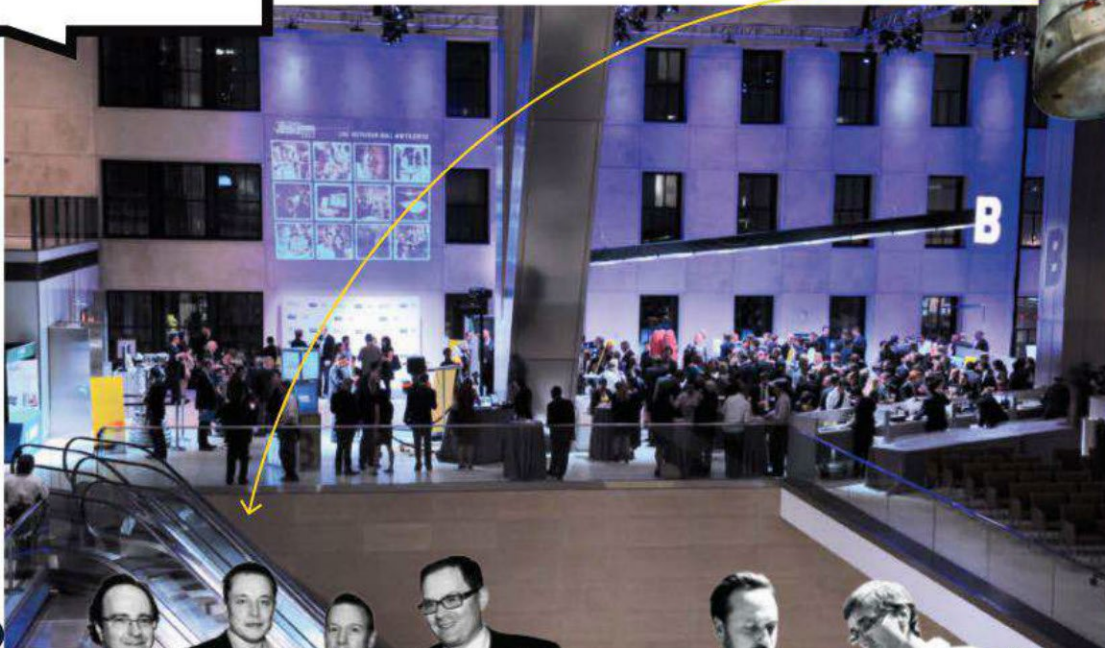


Blood and Gore
Intense Violence
Strong Language
Suggestive Themes
Use of Drugs

What We're Up To

(PM NEWS & EVENTS & STAFFERS ON THE SCENE)

Our eighth Breakthrough Awards filled (a) *Hearst Tower* in New York City with geniuses. Leadership Award winner and SpaceX CEO (b) *Elon Musk* posed with editor-in-chief *Jim Meigs*, Hearst chief technology officer *Philip Wiser*, and Hearst Magazines president *David Carey*. Auto editor (c) *Ben Wojdyla* talked metal micro-lattices with HRL Labs' *Alan Jacobsen*. Next-Generation winner (d) *Katherine Bomkamp* displayed her Pain Free Socket prosthesis. (e) *Musk* and *Meigs* discussed the future of spaceflight during the conference. Scientists from (f) the *University of Pittsburgh* and *Johns Hopkins* with *Tim Hemmes*, a paralyzed patient able to move a robotic arm with his thoughts thanks to their research.



a
b



c



IGNITION

d



e



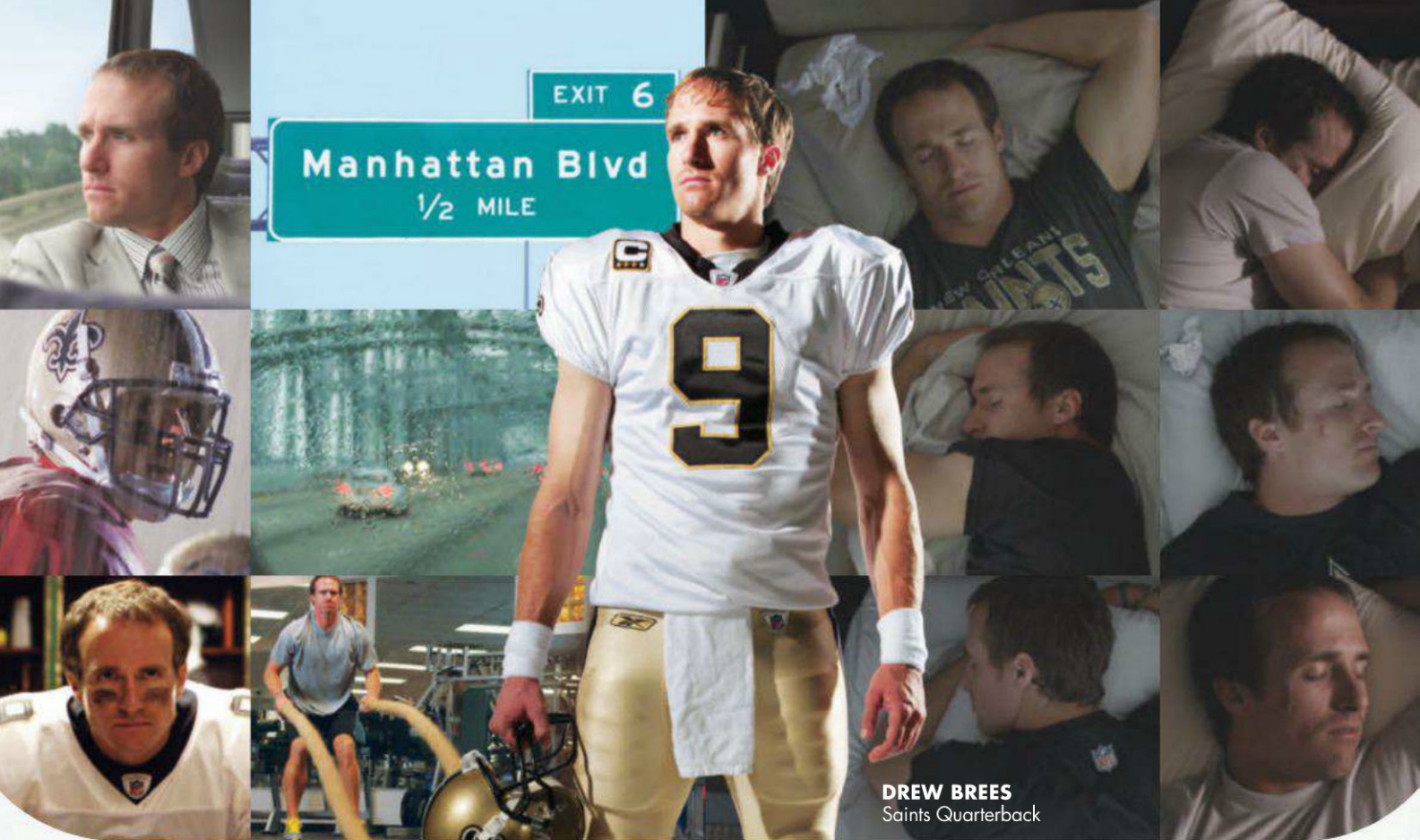
f



Popular Mechanics ANNUAL
BREAKTHROUGH
AWARDS

Tune In!

The 12-part series *Mankind: The Story of All of Us*, which features editor-in-chief Jim Meigs, airs on HISTORY for six consecutive nights, starting Nov. 13.



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Employee of the Month



No one here understands how **Glenn Derene** does it. His grasp on the complex workings of everything from Intel's processors to Chevy's transmissions is as tight as his Breakthrough Awards' guest list. Oh, and he has two sons under the age of 5.

IGNITION

"Why do car enthusiasts prefer a manual transmission over an automatic?"

Chaim E., 16, Brooklyn, N.Y.

In terms of acceleration, automatics have caught up to manuals, but a stick shift still puts you more in sync with the vehicle, according to Larry Webster, editor-in-chief of *Road & Track*. "In cars where the shift linkage is crisp and tight, the tactile feel of changing gears is immensely satisfying," he says. "And let's not forget that driving a manual-gearbox car is a skill, and who doesn't want to be able to do something that the next guy can't?" — **Steve Rousseau**

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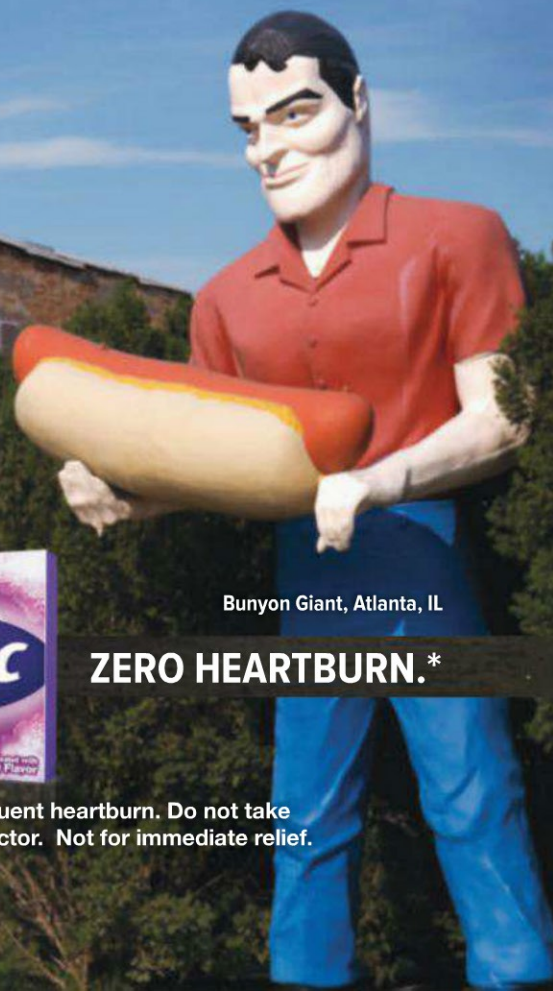


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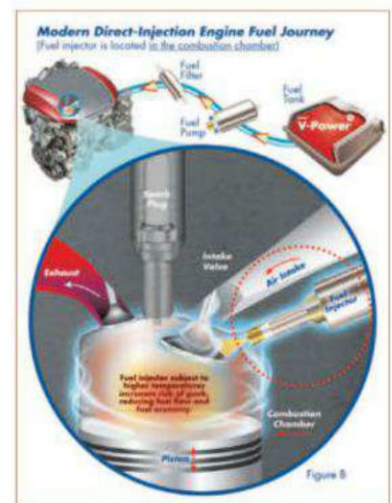
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ON THE WEB

Go to popularmechanics.com to revisit the no-performance cars of the malaise era (hello, Gremlin GT), learn secondary uses for tools you already own, and check out these other great stories:

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popularmechanics.com/newmpgcars

TECH MISTAKES

Every block seems to have a household that doesn't bother to rename its wireless network or use a password. And there are plenty of other blunders that users make with their gadgets right out of the box. Here's what not to do:

popularmechanics.com/techmistakes

IGNITION

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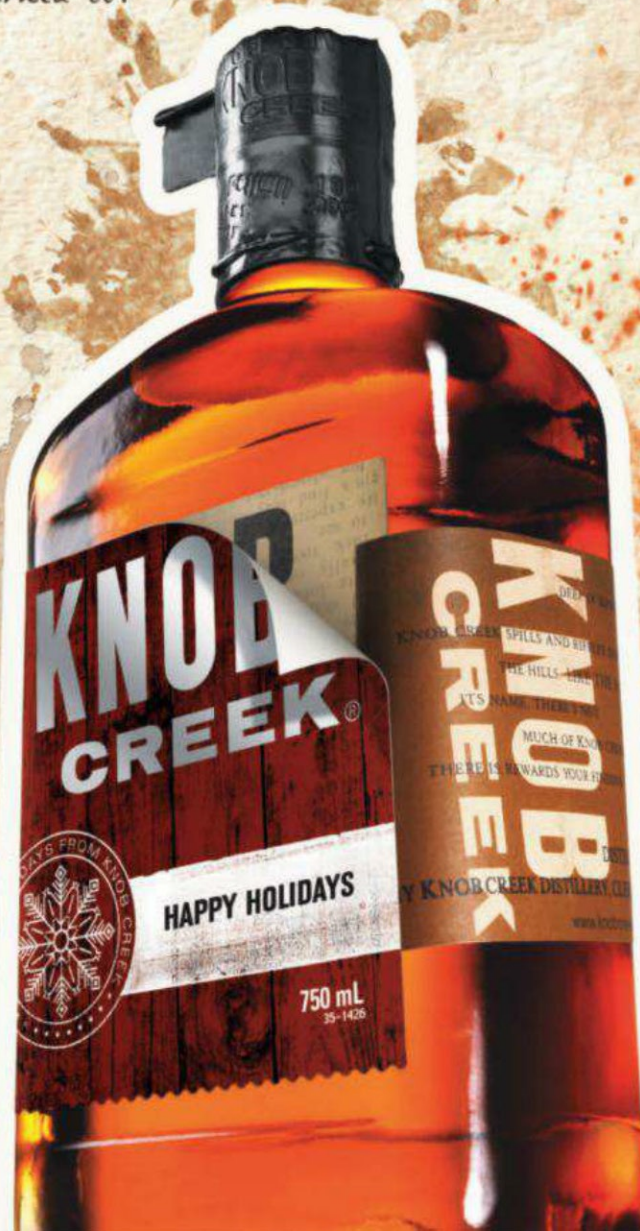
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AVIATION

The PopMech AeroDream

Tech

WATCH

NEWS

TRENDS

BREAKTHROUGHS



In real life there's no such thing as a perfect airplane. Every design element must balance benefits and disadvantages with regard to the nature of the intended mission. But never mind all that. PM decided to build the ultimate fantasy plane by choosing our favorite parts from different aircraft and kluging them together to create a Light-Sport Aircraft (LSA) that can operate year-round. We call this hot little number the PopMech AeroDream. — JEFF WISE

HOW
DOES
IT
FLY?

1: LANDING GEAR → We, ahem, borrowed the landing gear from the Akoya luxury LSA, which has skis for backcountry snow. With the flick of a switch, the craft also converts to a seaplane with hydrofoil blades.

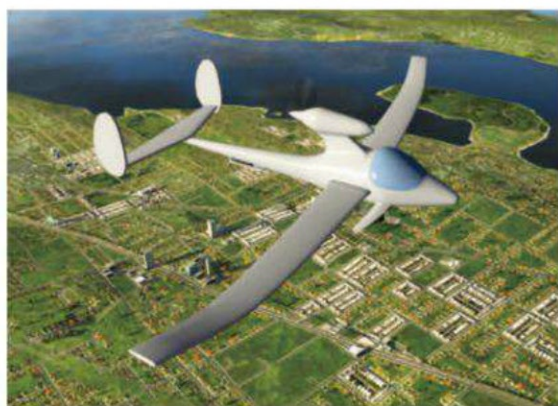
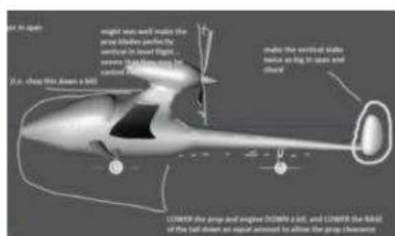
2: TAIL → In 1933 a young designer named Kelly Johnson solved instability problems in the Lockheed Electra by swapping its conventional tail for a striking H-shaped one. The AeroDream enjoys the same benefit at high speeds.

3: WINGS → Long, thin wings generate lift and save fuel. Pilots can shut off the engine and ride updrafting thermals as if in a glider. On the downside, moving the nose of an airplane with long wings up or down too much can cause a stall.

4: CANOPY → A bubble canopy offers all-around visibility and great situational awareness. Today the Evektor SportStar LSA is among the many recreational planes with a similar design.

5: ENGINE → When landing on seas, glaciers, or sand dunes, it's necessary for the propeller to be out of the way. We mounted ours atop the fuselage. The three short propeller blades generate the same power as two longer ones.

6: COCKPIT → Glass panels display synthetic vision maps that mesh satellite location with terrain databases. Collision avoidance is as easy as looking at the flight path overlaid on the moving map on the screen and taking appropriate action.



Clockwise from top left: Writer Jeff Wise annotated sketches from our illustrator to improve the AeroDream's handling. Austin Meyer, flight simulation expert, built a wireframe of the aircraft to test its performance. A full model in Meyer's X-Plane simulation.

SPECS

1300
TAKEOFF WEIGHT
(POUNDS)

28
FUEL (GALLONS)

950
TAKEOFF
DISTANCE (FEET)

1250
MAX CLIMB
(FEET PER MINUTE)

135
MAX SPEED
(KNOTS)

125
CRUISE SPEED
(KNOTS,
70% POWER)

650
RANGE (KNOTS,
AT CRUISE SPEED)

NOT CONTENT TO SIMPLY ILLUSTRATE THE POPMECH AeroDream, we solicited X-Plane flight simulator creator Austin Meyer for advice on the design—and a chance to see the aircraft soar onscreen.

Our first design had problems with the tail. Meyer recommended enlarging both the horizontal and vertical stabilizers. "It would fly a little better if you could lower the prop and engine and lower the base of the tail down an equal amount to allow the prop clearance," he advised.

That accomplished, we sent the new configuration to Meyer so that he could model the notional aircraft in flight. He does this by breaking the plane into about 100 sections and analyzing the aerodynamics of each part. These figures form the basis of the simulation.

The Flyer is airworthy but has its drawbacks. "Stability and control are good, but the prop is well above the center of gravity," Meyer says. "You must add power gently, pulling the stick aft, to avoid nosing over."

He also notes that the aircraft's twin vertical stabilizers are not in the wash of the propeller. "As a result, the vertical stabilizers are of very limited effectiveness at low speeds," Meyer says. "This means that the nose will pull to the side during takeoff."

So it's not perfect—but it's fun! Try flying it yourself at popularmechanics.com/xplane. — JOE PAPPALARDO



This craft is a tail-dragger (the third wheel is at the back of the airplane, not the front). If you jam the brakes during any ground operation, the craft will tip onto its nose.

— AUSTIN MEYER, CREATOR,
X-PLANE FLIGHT SIMULATOR

TECH WATCH

NEWS BRIEF / Magnetic Muscle

Researchers at Sandia National Laboratories use the Z machine to study mysteries of the universe. Here are three discoveries from 2012:

1. NEPTUNE'S WATER

Astrophysicists used the Z machine to hurl projectiles up to 60,000 mph at a tiny sample of water, creating pressures like those seen at the cores of giant ice planets such as Neptune. The water compressed to a quarter of its volume—much less than expected—forcing scientists to rethink their theories about how Neptune was formed.

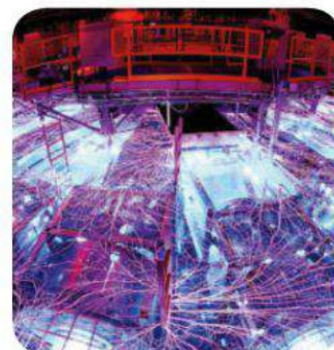
2. MAGNETIC FUSION

The Z machine's magnetic fields can implode tiny beryllium cylinders containing nuclear fuel. The next step, planned for 2013, is to add deuterium fuel. Simulations suggest that the result will release more energy than it consumes—a key to practical fusion power.

3. WHITE DWARFS

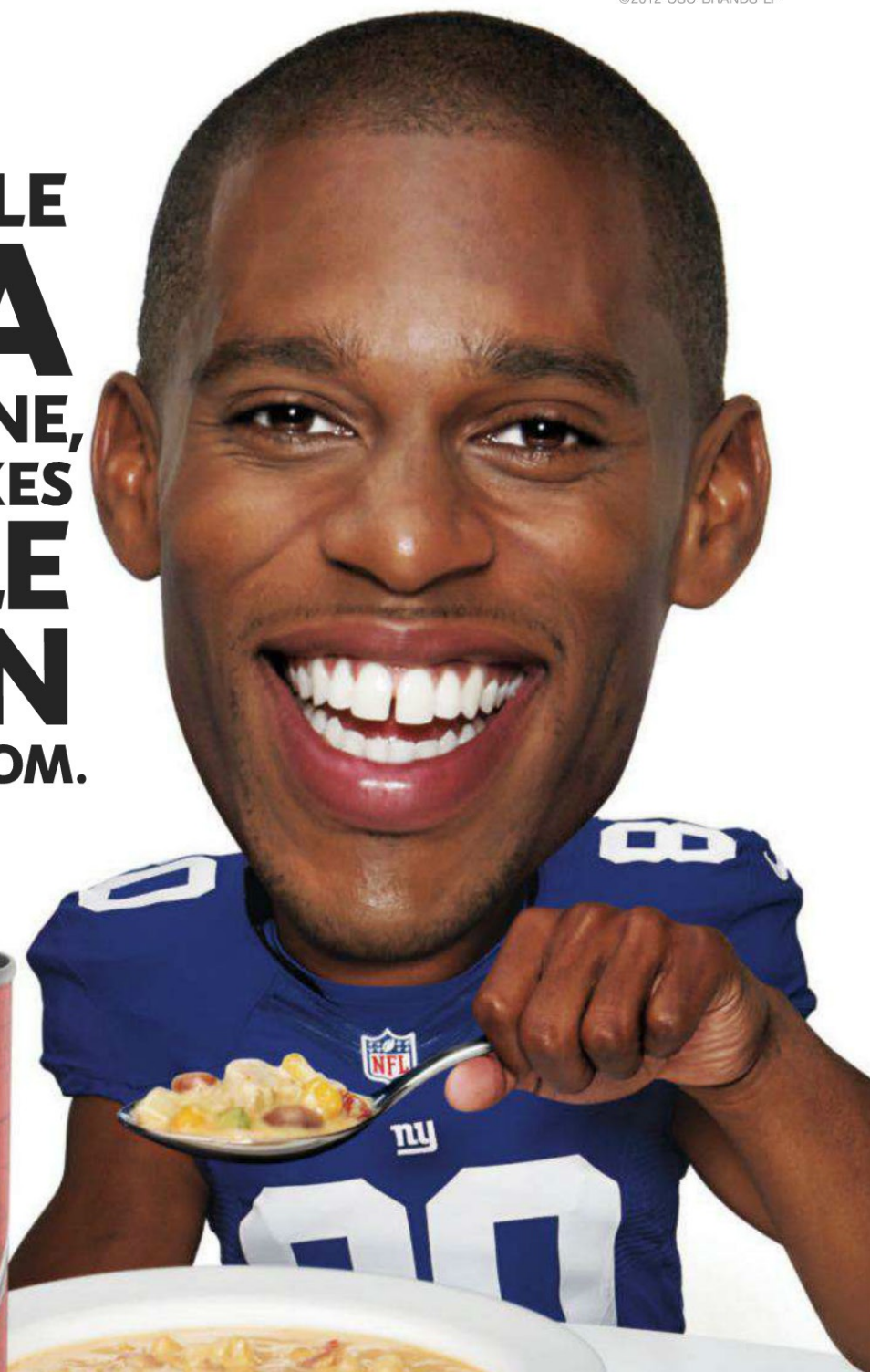
The Z machine can also crush hydrogen plasma, duplicating conditions seen on white dwarfs, the ultradense final state of stars like our sun. Researchers can now directly test the exotic properties they see through telescopes.

— ALEX HUTCHINSON



PHOTOGRAPH BY SANDIA (Z MACHINE)

AFTER A LITTLE
SALSA
IN THE END ZONE,
VICTOR CRUZ LIKES
**CHIPOTLE
CHICKEN**
IN THE LOCKER ROOM.



Big pieces of chicken and veggies
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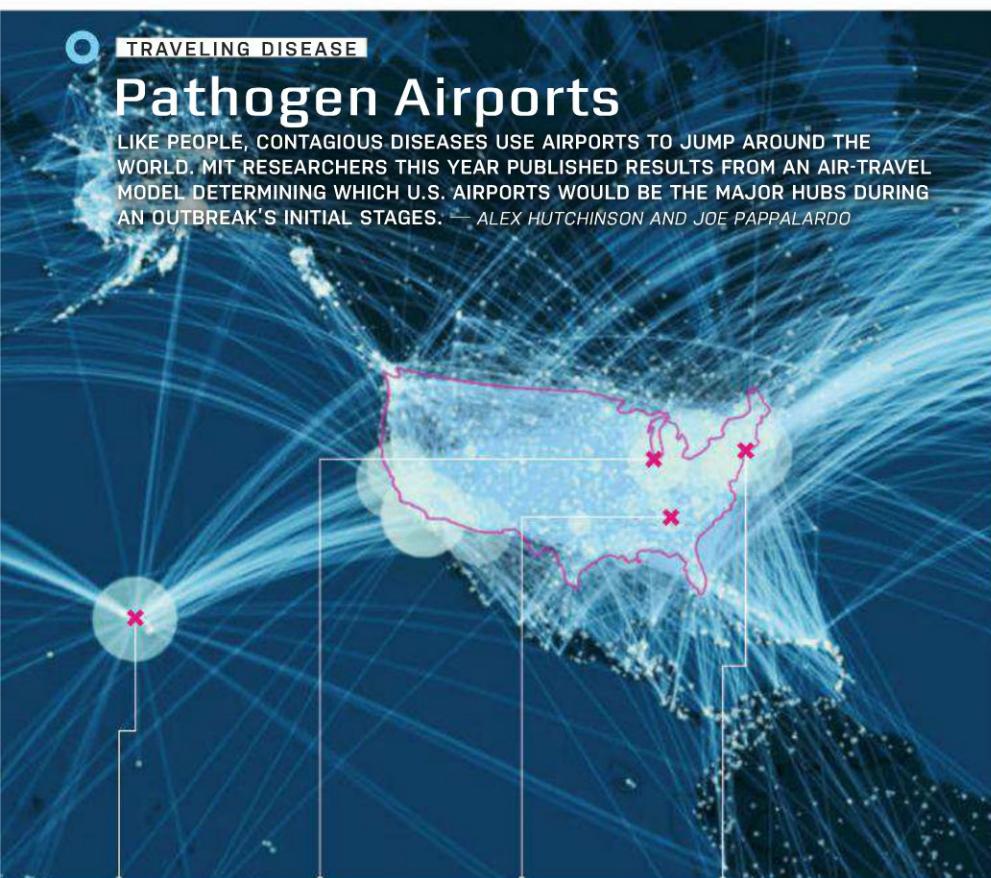
OFFICIAL SOUP SPONSOR OF THE NFL

Tristan Gooley,
natural navigation
expert

TRAVELING DISEASE

Pathogen Airports

LIKE PEOPLE, CONTAGIOUS DISEASES USE AIRPORTS TO JUMP AROUND THE WORLD. MIT RESEARCHERS THIS YEAR PUBLISHED RESULTS FROM AN AIR-TRAVEL MODEL DETERMINING WHICH U.S. AIRPORTS WOULD BE THE MAJOR HUBS DURING AN OUTBREAK'S INITIAL STAGES. — ALEX HUTCHINSON AND JOE PAPPALARDO


**HONOLULU
INTERNATIONAL**
HONOLULU

This hub came in at No. 3 on the list. Reasons: The Pacific is home to many emerging diseases, and the airport is a pass-through for travelers to and from far-flung Pacific nations.

**O'HARE
INTERNATIONAL**
CHICAGO

Notorious for flight delays, O'Hare presents a higher risk of infection because of travelers spending extended periods together in the airport.

**HARTSFIELD-
JACKSON
INTERNATIONAL**
ATLANTA

There is more to the list than passenger volume. Atlanta's airport boasts the nation's highest number of passengers but only ranks eighth on MIT's list.

**JOHN F.
KENNEDY
INTERNATIONAL**
NEW YORK

Ranks No. 1 as a "super spreader" in part because travelers using the airport tend to stay in the area longer between flights, increasing possible exposure to disease.



WHAT A CONCEPT

TECH WATCH

GIBBONS HUFFING HELIUM

Why would researchers in Japan induce gibbons to inhale helium? To record their high-pitched singing, of course. The differences between helium and helium-free singing revealed that gibbons actively control the vibrations of their vocal cords just as humans do, allowing the primates to communicate from more than 2 miles away. The gibbons' technique is the same one soprano opera singers use to amplify high notes, suggesting that the physical traits necessary for speech aren't uniquely human. — A.H.



Q

How can a tree tell you where you are?

A: The one thing that most people think they know about natural navigation is not true: Moss doesn't only grow on the north side of trees. Moss primarily seeks out bark with shallow gradients and coarse textures that can trap water. But trees can help travelers determine direction. In the northern hemisphere, the branches of isolated deciduous trees grow denser on the southern side, which faces the sun, so trees appear heavier on that side. Also, since tree limbs grow toward sunlight, the branches on the southern side tend to grow horizontally, while the branches on the northern side grow slightly upward. Prevailing wind, most often from southwest to northeast in the U.S., also bends the tops of trees to point northeast. — AS TOLD TO ALYSON SHEPPARD

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Its distinctive exterior styling lets you know that this isn't the typical luxury car. And with the most powerful standard engine in its class; it pushes the boundaries of what a performance luxury vehicle can be. Making you feel alive with every drive. The 420-hp Infiniti M*.



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*MY12 M56 claim based on eAutoPacific.com Executive Luxury segment 2011 against models priced \$71,300 and under. Always wear your seat belt, and please don't drink and drive. ©2012 INFINITI.



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Visitor's Guide to ...

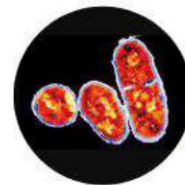
THE HUMAN MICROBIOME

Tens of thousands of species of bacteria colonize your body. Some thrive in armpits, while others enjoy drier places such as the hands. Luckily, most of the little buggers help you stay healthy. "They can live in harmony on your body as long as there's a diversity of bacteria to keep them in check," says National Institutes of Health geneticist Julie Segre. Here are some of the organisms that call your body their universe. — SARAH FECHT



EARS

About 2000 species of bacteria live behind the ear—10 times fewer than in the intestine. "They have done a good job of outcompeting other species," Segre says.



FOREHEAD

Bacteria such as *Propionibacterium acnes*, enemy of teenagers everywhere, feed on the skin's oil.



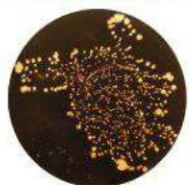
ARMPITS

There's a reason why armpits smell bad: The bacteria living there break down sweat into stinky fatty acids. Different species of bacteria create distinct smells.



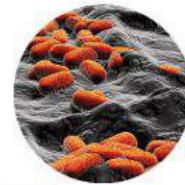
NOSE

Sufferers of chronic rhinosinusitis (inflamed sinuses) tend to have simpler bacterial ecosystems than those with healthy noses. Future treatments could diversify nasal bacterial populations.



BELLY BUTTON

After swabbing 200 belly buttons, researchers in North Carolina counted nearly 4000 strains of bacteria, some completely new to science. Innies have more microbes than outties.



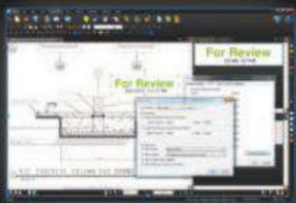
GUT

A healthy human gut is a diverse area, hosting an estimated 30,000 species of bacteria. Some species help us absorb food and calories.

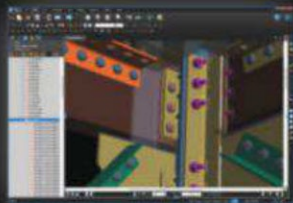
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Bluebeam Studio™ is the ultimate cloud-based solution for collaboration. Included in Bluebeam® Revu®, Studio allows you to manage projects digitally from start to finish anywhere, at any time. Store and manage an unlimited number of PDFs and any other file type in the cloud for free, and invite project partners to check-out and edit those files. Collaborate on the fly by adding PDFs into online Studio sessions, where you and your project partners can redline the same PDF with industry-standard markups from a desktop, tablet PC or iPad. Complete design reviews, share schematics, and speed up fabrication schedules by reviewing 3D PDF drawings in real time – there are no limits to what you can do when leveraging the combined power of Revu and Studio.

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Noctilucent Cloud

ky watchers and even astronauts in orbit have long observed wispy electric-blue clouds glowing on the fringes of space. Theories abounded over the origin of these noctilucent clouds (NLCs), but a NASA mission has found a clue: traces of extraterrestrial smoke. Researchers with the Aeronomy of Ice in the Mesosphere (AIM) mission can determine the chemical composition of NLCs by the way light reacts to the particles. "We've detected bits of 'meteor smoke' embedded in noctilucent clouds," reports AIM principal investigator James Russell. Ice crystals grow around tiny bits of cosmic matter left behind when meteors burn up in the atmosphere; when sunlight strikes the haze, it scatters in short wavelengths, making the clouds appear to glow blue. — JOE PAPPALARDO



NASA has found that blue-hued, high-altitude clouds like the ones at left have an extraterrestrial origin.

TECH WATCH



NEWS BRIEF / NASA's New Mars Mission

NASA's newly approved mission to Mars, InSight (Interior Exploration Using Seismic Investigations, Geodesy and Heat Transport), will seek clues to planetary creation. InSight could answer questions about Earth's formation since both planets are classified as terrestrial (rocky), but Mars is less geophysically active and thus has a better preserved early history.

WHO NASA Jet Propulsion Laboratory

WHAT Rather than roving the surface like Curiosity, Spirit, or Opportunity, InSight will stay where it lands. It will carry instruments to determine the planet's rotation axis, a subsurface heat probe, and a tool to measure seismic "marsquakes."

WHEN Scheduled landing on Mars, September 2016; mission continues for two years.

HOW MUCH InSight was funded under NASA's Discovery Program, which sponsors higher risk, less expensive solar-system exploration missions with highly focused scientific goals. The Mars Science Lab rover mission cost \$2.5 billion; InSight will tally only about \$425 million. — J.P.

EMERGENCY EQUIPMENT

Molten Entry

NO PADLOCK OR CHAIN CAN WITHSTAND A BLAST FROM A NEW TORCH BEING DEVELOPED FOR POLICE AND SOLDIERS.



A Metal Vapor Torch (MVT) is the size of a flashlight but packs the punch of a lightsaber. The tool is made for police and military personnel to cut through bolts, chains, and padlocks at high speed. The handheld device's blade of flame can slice through a half-inch steel bar in less than a second. The MVT, developed by Energetic Materials & Products of Round Rock, Texas, uses solid fuel and an oxidizer, making it lighter and more compact than traditional gas-powered oxyacetylene torches. Company CEO Dennis Wilson says that the torch will cost about \$150—a competitive price for local police departments—and cartridges will go for \$50 each. A preproduction version of the MVT will be shipped later this year; user feedback will help shape the production model. — DAVID HAMBLING

HOW IT WORKS

1 / At the heart of the MVT is a reaction between copper oxide and precisely graded particles of magnesium and aluminum that produces a 5000 F jet of flame.

2 / The jet has higher energy density than a gas flame, and the cutting action is the result of a combination of heat and abrasion by particles of metal oxide.

3 / A rectangular carbon-fiber nozzle shapes the jet into a flat blade for cutting through bars.



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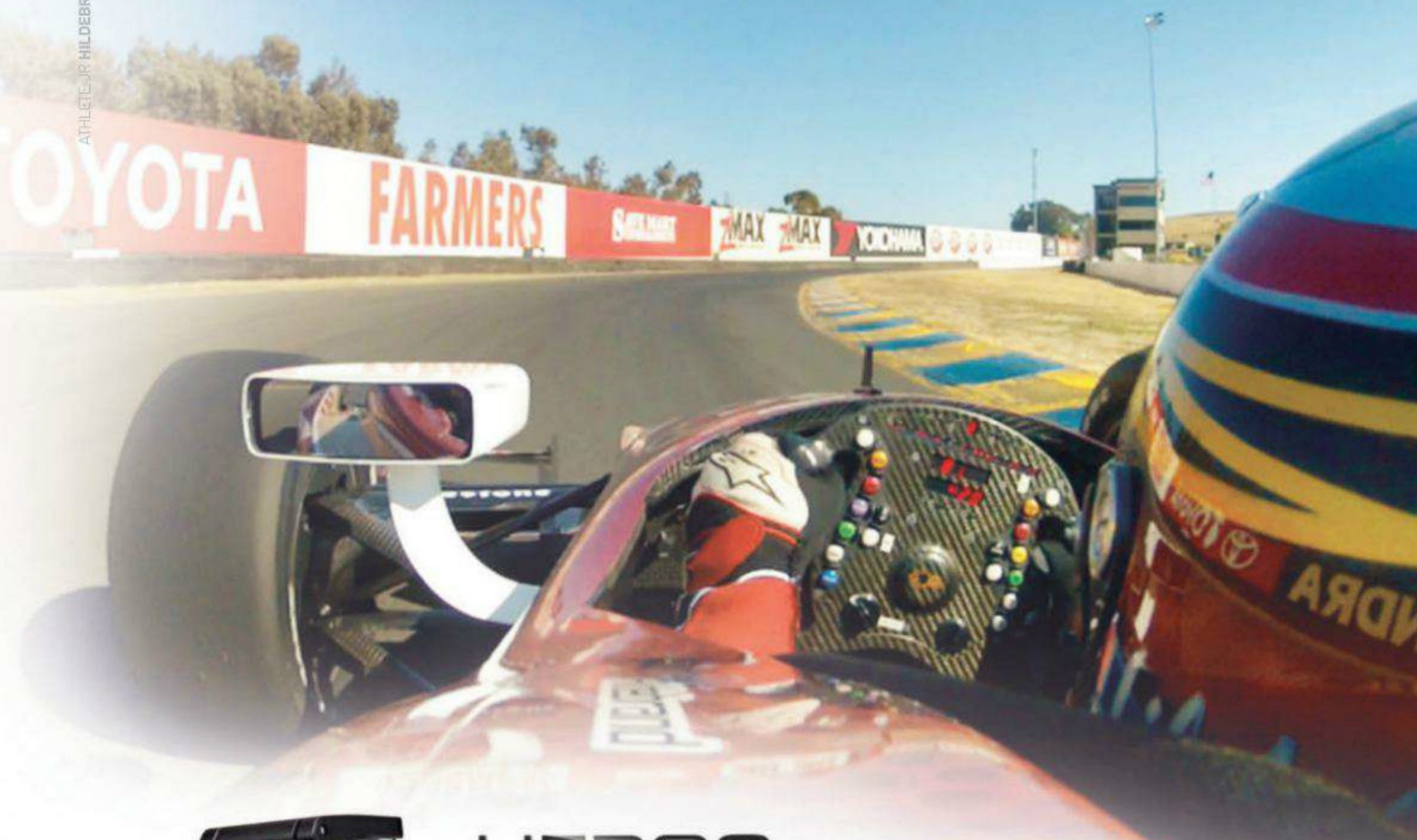
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Pole Mount



Chest Mount, aka
"Chesty"



Helmet Front Mount



Adhesive Mounts

PHOTOGRAPHS BY PHILIP FRIEDMAN

BEST GEAR & GADGETS 30 PRIZES IN 30 DAYS

*Sweepstakes:
For one month
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we'll give away one
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ggsweeps](http://popularmechanics.com/ggsweeps) for details,
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REALLY

GREAT

STUFF!

Upgrade

2

SPECIAL
PULLOUT
SECTION



Give and Let Buy

Buying the right gift isn't just about choosing the right object, it's also about really knowing the person you're shopping for. In these 10 pages you'll find something for everyone, from the master chef of the house to the master builder of that house. Or you can treat yourself. But no rush—these ideas are fresh year-round. — RACHEL Z. ARNDT; ADDITIONAL REPORTING BY STEVE ROUSSEAU

Random draw sweepstakes: No purchase necessary to enter or win. 30 Prizes in 30 Days: The Popular Mechanics Gear and Gadget Daily Sweepstakes. Sponsored by Hearst Communications, Inc. Beginning November 13, 2012, at 12:01 AM (ET) through December 12, 2012, at 11:59 PM (ET) go to popularmechanics.com/ggsweeps and complete and submit the entry form pursuant to the online instructions. Each daily sweepstakes is a separate drawing offering a separate prize and must be entered separately. Odds of winning will depend upon the total number of eligible entries received. Must be a legal resident of the 50 United States, District of Columbia, Puerto Rico, or Canada who has reached the age of majority in his or her state, territory, or province of residence at time of entry. Void in the Province of Quebec and where prohibited by law. Sweepstakes subject to complete official rules available at <http://www.popularmechanics.com/technology/gadgets/news/gift-guide-official-rules>.

2012
WISH LIST
THE
AUTEUR

Acme Made Montgomery Street Backpack /// \$100

Camera bags don't have to be ugly. This pack is sharp-looking and functional: It has a side zipper for quick and easy access and fits a 13-inch laptop, DSLR camera, additional lenses, and other accessories.

Canon EOS Rebel T4i 18-135mm IS STM Lens Kit /// \$1200

This is the one item that an ambitious new filmmaker should own. Although it's pricey, the 18-megapixel Rebel shoots 1080p HD video to rival cameras that cost three or even four times as much, and the kit includes a good all-purpose starter lens. Key feature: focus via touchscreen.

UPGRADE



1. Riseful RollPro III /// \$60

As the GoPro has grown more popular, so have accessories for the adventure camera. Hauling all that gear on your next thrill-seeking exploit is now easier than ever with this roll-up bag.

2. Litepanels Micro LED /// \$200

Unless you're shooting film noir, darkness is the filmmaker's enemy.

Illuminate a scene with this panel that mounts directly onto a DSLR. Adjustable via a dimmer dial, the light runs for 1.5 hours on four AA batteries, and—thanks to the LEDs—it won't become too hot to handle.

3. MovieSlate /// \$25

This digital version of the classic movie slate is also a clapper board, shot log, and notepad. The shot log

is searchable, and the app can be remotely controlled via another iOS device.

4. Olympus LS-100 Audio Recorder /// \$399

When a director wishes to capture every syllable of actors' dialogue, this two-channel audio recorder with shotgun mic will do the job. Its sturdy construction ensures that it'll be around for years.

5. Brookstone HDMI Pocket Projector /// \$300

Once you've shot your magnum opus, show it off. This device projects up to 60 inches in full 1080p HD at 85 lumens and comes with an HDMI cable.

6. Opteka CXS-1 Video Shoulder System /// \$90

No matter how steady the hands that hold the camera,

they're bound to make the image shaky. This light-weight aluminum and stainless-steel shoulder rig has foam padding for comfort and stability.

7. Alfred Hitchcock: The Masterpiece Collection /// \$225

Inspire your auteur with this boxed set, which includes 14 films, hours of bonus footage, and a collectible book.

STOCKING STUFFER

ROSEMARY'S BABY CRITERION COLLECTION DVD /// \$25

One of the creepiest horror films of all time is also one of the most highly anticipated Criterion Collection restorations.



1



2



3



4



5



6



7



1

1. Black & Decker Belgian Waffle Maker

/// \$25

Who needs a panini press when you've got a waffle maker? This Black & Decker iron is meant for breakfast fare, but it's just as good at pressing sandwiches into meat-and-melted-cheese delights.

2. SousVide Supreme Demi

/// \$329

Once the province of high-tech restaurants, the *sous vide* method—a fancy way of slow cooking—can now happen at home.



2



3

SPLURGE

3. Miyabi Artisan SG2 8-inch Chef's Knife

/// \$200

Sorry, but that infomercial knife isn't cutting it anymore. The heart of a real cook's arsenal is a high-quality knife such as the SG2. The blade is made of nickel and stainless steel hammered around a super-strong powder-steel core.

4. Weber Smokey Mountain Cooker

/// \$400

Preparing meats with low heat in several hours not only imparts more smokey flavor than grilling, it also nearly guarantees a moist, tender finished product.

5. Best Made Company Apron

/// \$58

This apron is the Carhartt coverall of the kitchen. It's made for the shop, but it still fits when you're working the stove or the grill. Use the hammer loop to hang your tongs. See?



4

Source by SodaStream /// \$99

Bubbly water blows away the flat stuff. Fizz is applied via a carbon-dioxide infuser that can be dialed up or down to adjust effervescence. SodaStream also offers flavorings to make soft drinks, helping reduce can and bottle waste.

2012
WISH LIST
THE
TASTEMAKER



5

UPGRADE

STOCKING STUFFER



HERMETUS BOTTLE OPENER AND RESEALER /// \$9

Sure, an unfinished beer is a rarity. But when you just can't polish off that 14 percent barleywine, this bottle opener is a boon. Serrated edges help you twist the cap back on so the bubbles will still be there tomorrow.

EDIFICE

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EQWM1100CG-1



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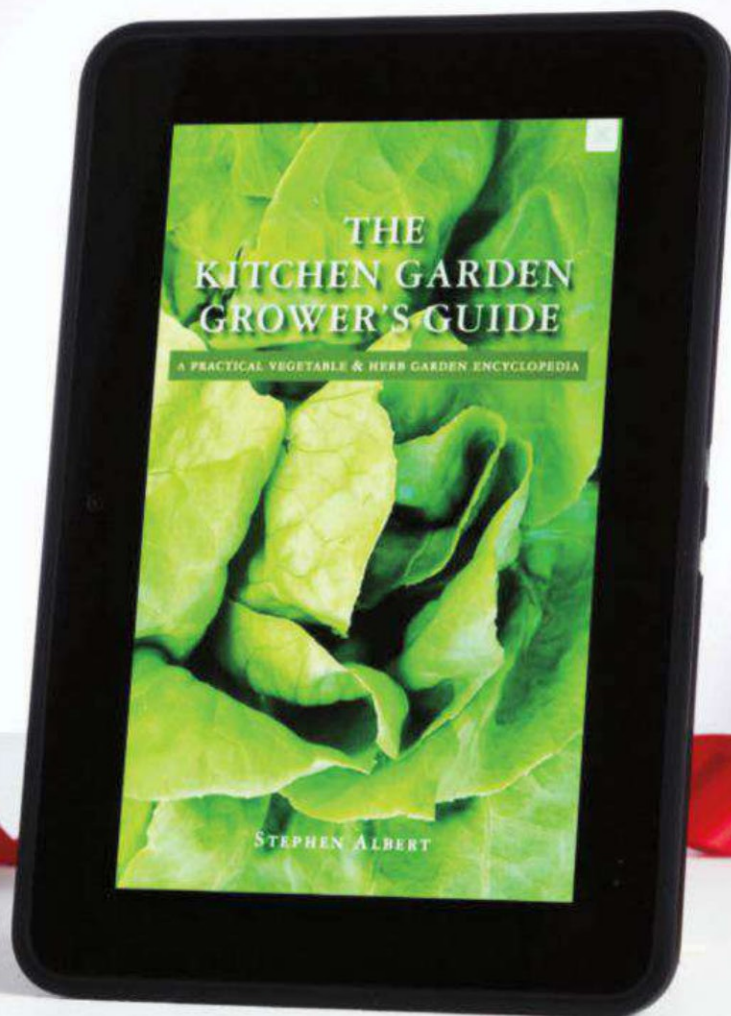


ATOMIC TIMEKEEPING

MULTI-BAND TECHNOLOGY RECEIVES TIME CALIBRATION SIGNALS AUTOMATICALLY FROM UP TO SIX TRANSMITTERS AROUND THE WORLD (US, UK, GERMANY, JAPAN X 2 AND CHINA). THIS TECHNOLOGY ALSO ADJUSTS FOR LEAP YEAR AND DAYLIGHT SAVING TIME.

CASIO

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2012
WISH LIST
THE
TERRAFORMER

Amazon Kindle Fire HD /// \$200 + **The Kitchen Garden Grower's Guide** /// \$10

At 7 inches, the smaller of Amazon's two Kindle Fire HDs is perfect for carrying around the yard, especially loaded with the go-to book for both enthusiastic beginners and seasoned pros.

UPGRADE



1. Dickies Rigid Duck Chore Coat /// \$80

Rugged but comfortable 10-ounce cotton duck makes this jacket perfect for doing yardwork on a raw day.

2. Artifact Bag Co. Tool/Garden Tote /// \$175

Chris Hughes makes these tote bags in his Nebraska workshop, hammering on the copper rivets and hand-cutting bridle leather for the handles.

3. Bahco Clearing Axe /// \$53

For some jobs a chain saw is overkill. Replace this lightweight ax's blade when it dulls so you can hack through trees year after year—and feel like a woodsman doing it.

4. Valley Oak Tool Company Broadfork /// \$195

Cultivate compacted soil by stepping on the wide treadbar to drive the 12-inch pointed steel tines into the ground. Be very careful not to aerate your foot.

5. Blundstone 560 Series Boot /// \$200

A Thinsulate liner, leather uppers, and tough treads make for some mean gardening boots. Soles reinforced with steel add sturdiness and put a metallic spring in your step.

STOCKING STUFFER



FIELD NOTES COUNTY FAIR 3-PACK /// \$10

These memo books' heavy linen covers [customized for your state of choice] keep each of the 48 pages within protected from yardwork splatter.

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1



2

UPGRADE



1. Pro-Ject Debut Carbon Turntable /// \$400

Vinyl offers a more nuanced sound than digital recordings, but turntables often race past the \$1000 mark. The Pro-Ject Debut comes in at less than half that and includes a carbon-fiber arm and a slew of color options for the base.

2. B&W P3 Headphones /// \$200

Acclaimed speaker-maker Bowers & Wilkins puts its aural genius into these lightweight foldable headphones. We're especially impressed by the balance of treble and bass.

3. Snark Super Tight All Instrument Tuner /// \$39

By sensing pitch based on vibration, the Snark can tune on the loudest of stages. The device clips on tighter than similar tuners, has a metronome, and even allows tuning with a capo on.

4. Hohner Marine Band Harmonica /// \$43

Played by Sonny Terry, Little Walter, and Bob Dylan, this is the classic harp for blues, country, folk, and rock. Because it's set up to play a single key, you can't really hit a wrong note on the harmonica's 10 holes and 20 reeds. Getting started is as easy as breathing in and out.

5. Pianocade /// \$255

Re-creating the 8-bit bleeps and bleeps of arcade-game music is easy with the Pianocade. Part synthesizer, part MIDI controller, this hybrid chiptune piano comes packed with a 128-note range and synthesis hardware based on that of classic gaming systems. No quarters required.



STOCKING STUFFER



4



5

Audioengine 5+ Speakers /// \$400

Within the handmade wooden cabinets are Kevlar subwoofers, silk tweeters, and an amplifier that unites those drivers, creating crisp, balanced audio. The speakers are simple to set up—they can connect to virtually anything with a headphone jack or RCA cables—and can even charge Apple devices via USB. All that, and they're handsome too.



2012
WISH LIST
THE
IMPRESARIO



SPLURGE

FOR THE INTERNET AUDIOPHILE



DISCOGS.COM /// Name-dropped by folk band Bon Iver at a recent Radio City Music Hall show, this is the go-to site for buying, selling, and talking vinyl. **RDIO** /// free to \$9.99 a month Rdio may have fewer tunes than Spotify, but it offers an interface better suited for discovering new music.

Self-leveling ceiling
mount model



“A better idea”

– MEN’S JOURNAL

“Impressively high-tech”

– GIZMODO

“I imagine Steve Jobs would have a RoboReel product at his house.”

– GADGET KING

“RoboReel is a lazy neat freak’s salvation.”

– GEAR PATROL

“The RoboReel has managed to pack more technological advancement, safety and features into a single device than just about all other cord reels combined.”

– HOME FIXATED

“One of the coolest inventions that I didn’t know I needed.”

– MARC SPAGNUOLO, THE WOOD WHISPERER

“Wicked awesome”

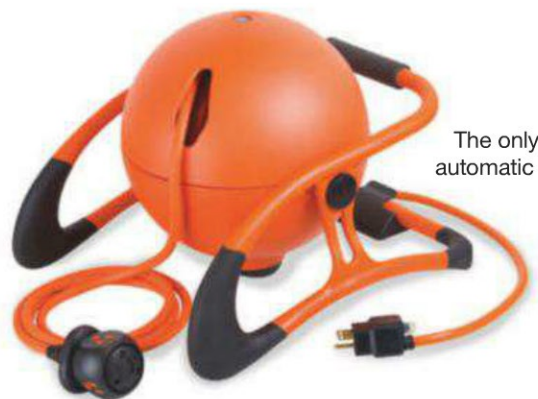
– TOOL-RANK

“There are less expensive solutions. Of course, then you can’t brag that you have a robot in your garage.”

– NEW YORK TIMES GADGET WISE

“In a word, it’s genius.”

– EMERCEDESBENZ.COM



The only portable
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Introducing RoboReel—the \$299 power cord reel that’s worth every penny. To find out what’s got the reviewers so amped, visit roboreel.com or call 888-GR8-STUFF.

ROBOREEL

1. House of Marley Bag of Rhythm /// \$350

The 21st-century workshop deserves something better than a dusty old boombox. Made of canvas and FSC-certified birch, this system connects via a cable to just about any device. A pair of subwoofers, 1-inch tweeters, and a powerful amplifier crank your tunes above the din of the band saw.

2. Rockwell BenchJaw /// \$130

You can always use an extra pair of hands around the shop. Controlled by a foot pedal, Rockwell's BenchJaw clamps down with up to 1200 pounds of pressure. With a range of 16 inches and a 220-pound-load capacity, there's almost nothing it can't grip.

3. Stanley Sweetheart No. 4 Smoothing Bench Plane /// \$190

It may look like a museum piece, but this plane is a true workshop workhorse. Reimagined for the modern woodworker, the Sweetheart No. 4 has cherry handles and an extra-thick iron, while its base and frog components are cast as a single piece to reduce chatter.

4. Worx Semi-Automatic Driver /// \$50

When it comes to power tools, sometimes little is good. This 4-volt cordless driver packs up to six bits in a revolver-style moon clip. Cock back the tool's slide-action housing until it clicks, and you've changed the bit. Go ahead, small-but-frustrating DIY project—make my day.

5. Carhartt R37 Bib Overalls /// \$88

We have nothing against a nice pair of jeans and a trusty flannel shirt. But these durable overalls provide better functionality and longer wear when you're on the DIY trail. Zippers on both sides make them a cinch to get into and out of, so you have no excuse not to suit up properly.



2012 WISH LIST THE MAKER

Black & Decker Matrix Quick Connect System /// \$70; attachments, \$30 to \$40 each
Kits with a single powerhouse and multiple attachments are all the rage. The heart of this system is a 20-volt li-ion drill head that attaches to a handle and trigger. Unclick the head and snap on tools such as a jigsaw or detail sander.





UPGRADE

STOCKING STUFFER

Estwing English Pattern Claw Hammer /// \$40

This tool is a joy to hold—and behold. The 24-ounce hammer is forged from one piece of steel, so you'll never break off its head, regardless of how many botched swings you make. The leather ferrule handle only gets better with age and provides just the right amount of grip.

1. Fratelli Orsini Driving Gloves /// \$96

Nothing complements a full stable of horses under the hood like a serious pair of driving gloves. Hand-stitched in Italy, this lambskin pair improves grip.

2. Pendleton Motor Robe /// \$88

Sometimes you have to think of the person

in the passenger seat. First introduced as a Model T accessory, this virgin wool blanket will keep your companion cozy.

3. Quik Chek Tire Pressure Indicator /// \$17

Properly inflated tires improve handling, tread life, and fuel economy. Press a

button on the gauge—which stays on the tire all the time—and a colored line tells you the psi.

4. Popular Mechanics Used Car Checklist /// Free

This iPhone app from the auto pros at PM leads you through a simple 101-point inspection of a used

car and provides a score, plus expert tips. It's a must-have tool for car shoppers.

5. BlackJack Tire Repair Kit /// \$57

You're on the shoulder. A nail has punctured your tread. This kit will save you with the tools to remove the nail and insert a butyl rubber

repair strip. (You have an air pump in the trunk, right?)

6. GoPoint Technology BT1 /// \$70

GoPoint's iOS-based OBD-II scanner was a 2010 POPULAR MECHANICS Breakthrough Products winner. The newest app uses a Bluetooth connection to display data.

UPGRADE

**Grant Mahogany Collector's Edition Steering Wheel** /// \$330

With the exception of the steering wheels in some classic or expensive cars, the stock part rarely provides the look and control that a custom wheel does. Your driver will appreciate the upgrade.



2012 WISH LIST

THE CAR CONNOISSEUR

STOCKING STUFFER

MCQUEEN'S MACHINES /// \$15

Steve McQueen's love of cars and motorsports is well-known; this book depicts the icon's passion like no other tome, cataloging vehicles from both films and McQueen's own collection.



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1. Sphero /// \$129
Early tech adopters will flip for Sphero, a smartphone- and tablet-controlled robot. The device doubles as a controller for tablet games. Just try prying it out of your kids' hands—we dare you.

2. Nerf N-Strike Elite Hail-Fire Blaster /// \$40
Give your child a leg up on the playtime

battlefield with this battery-powered weapon. With eight clips that hold 144 rounds and a range of 75 feet, the Hail-Fire lives up to its name.

3. Zoomy Handheld Digital Microscope /// \$40
Mounting specimens on slides is so last century. This scope lets kids observe and record the miniature world with the help of

a computer. The Zoomy connects via USB and transmits magnified images to the screen for printing.

4. SmartLab The Amazing Squishy T. Rex /// \$28
Kids love goopy gross-out stuff, and many of them also love dinosaurs. This anatomically correct model scores on both counts and offers the opportunity to get to

know a dino from the inside out.

5. Nat Geo WILD Anteater Bug Vac /// \$40

Just as in real life, bugs enter through the anteater's snout and end up in the stomach, which is made of clear plastic and is removable. This creature gives a good view of its ant-filled insides.

6. LittleBits Starter Kit /// \$89

Calling all young engineers! This set has mini electronics components—each with a different function, such as producing light or sound—that connect via magnets. Tiny hard hat optional.



Kre-O Transformers Battle for Energon Set /// \$40
One-up classic Legos with this Kre-O set, which features four tiny figures and 379 bricks that kids use to build the Energon vault and the Transformers—Optimus Prime and Megatron, naturally—as robots or as robots-in-disguise.

**2012
WISH LIST
THE
LITTLE
GENIUS**



UPGRADE



SPLURGE



STOCKING STUFFER



HEXBUG LARVA /// \$15 Caution: This robot has a very high yuck factor. It slithers just like real larvae and reacts to its environment, switching direction when it senses an obstacle. So disgusting but so fun.

Check Engine Light?



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Know what's going on with your vehicle before you take it to the mechanic. Or better yet save yourself a trip and hundreds of dollars! GoPoint Technology's BT1 Wireless Tool works with your Apple iPhone, iPod touch or iPad to remove the risks and surprises from driving. Simply plug the BT1 into your vehicle and download the app to access check engine light data and translate error codes. Retrieves service bulletins, safety recalls, analyzes fuel consumption relative to driving habits and more! Works on 1996 MY vehicles and newer. See our website for more apps.*

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"**This product is great.** Now I don't have to call a mechanic everytime the car feels like its running funny. I can check it myself."

ELover08

"I've been getting a check engine light that comes and goes. I connected my iPod and it found a problem with one of the oxygen sensor heater circuits. It turned out to be a poor electrical connection. I was able to **repair it myself and avoid a hefty mechanic's bill!** I would say it paid for itself right out of the box!"

Tom7601



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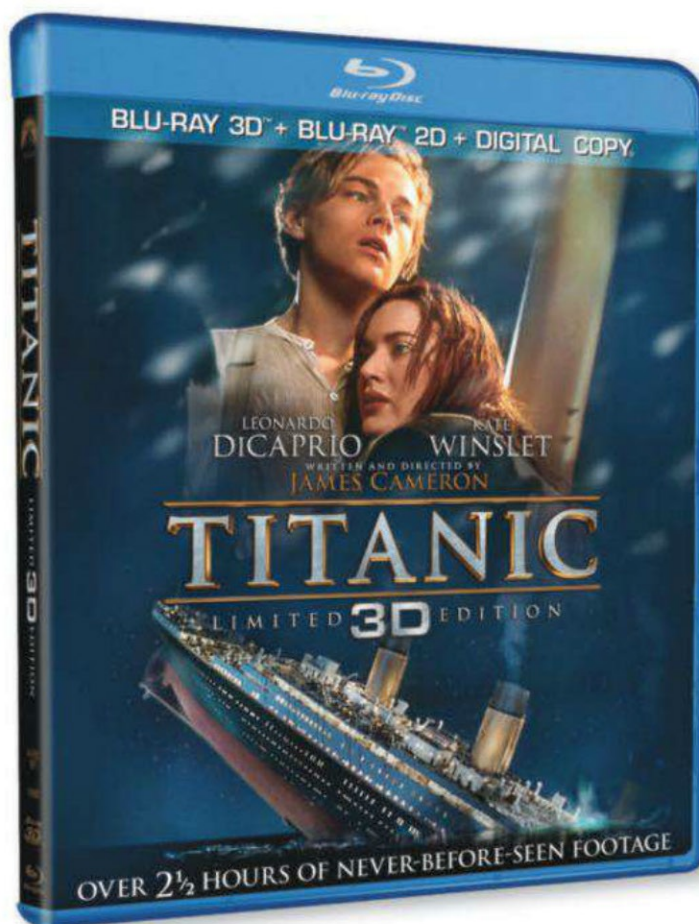
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Auto I N T E L

TEST DRIVES

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HOT RIDES

3

Welcome to the future. We've come a long way since buying a true lemon was a danger: Quality engineering is a given across all segments. And details that were once limited to only luxury vehicles are expected by all consumers: superior fit and finish, crisp driving performance, and smart technology. With carmakers delivering on all these fronts, parsing the best of the best is trickier than ever. The old requisites remain, but now we turn our attention to those automotive qualities that are of pivotal importance to the 21st century: fuel efficiency, technological integration, and distinctive, bold styling. And even though we love a high-performance supercar or luxo-cruiser as much as the next auto enthusiast, we reserve our highest praise for those vehicles that can bring the best engineering to the most people. Our list is not a compilation of pipe dreams (well, maybe one). These are obtainable vehicles for real consumers. We've driven every new car and truck, and these are the ones that shine. For us, these cars are the new benchmarks—at least until next year. — **THE PM AUTO TEAM**



DOWN THE ROAD

Subaru BRZ/Scion FR-S



Chevrolet Camaro ZL1



Ram 1500



Cadillac ATS



SRT Viper



Nissan Pathfinder



2013 AUTOMOTIVE EXCELLENCE AWARDS

FORD ESCAPE

Base Price: \$23,295

► *Car of the Year*



○ This year we introduce our first-ever POPULAR MECHANICS Car of the Year. This is an affordable vehicle that excels in multiple auto excellence categories, not just one. No vehicle hit a variety of marks harder or topped more editors' scorecards than the all-new 2013 Ford Escape.

The Escape is freshly minted, with a solid new chassis shared with the European Ford Kuga. It's still a compact crossover, but there's more room inside for people and gear. The driving experience feels like it's two full generational leaps ahead of the old Escape, a perennial best seller for Ford. Its moves are athletic and nimble, yet when equipped with the towing package, it can pull 3500 pounds. The Escape's optional intelligent all-wheel-drive system gathers data from sensors and can preemptively split the torque between the axles through an electromagnetic clutch. There are two turbocharged EcoBoost engines, a potent 178-hp 1.6-liter four-cylinder and a 240-hp 2.0-liter powerhouse. The more frugal Escape returns a laudable 33 mpg on the highway. The Escape offers a suite of optional safety systems and introduces the hands-free power liftgate to the segment (just kick your foot under the rear bumper to trigger a sensor). The all-new Escape is fun, smart, and practical—everything a PM Car of the Year should be.

Tesla Model S



Hyundai Elantra GT



Prius C



2013 AUTOMOTIVE EXCELLENCE AWARDS

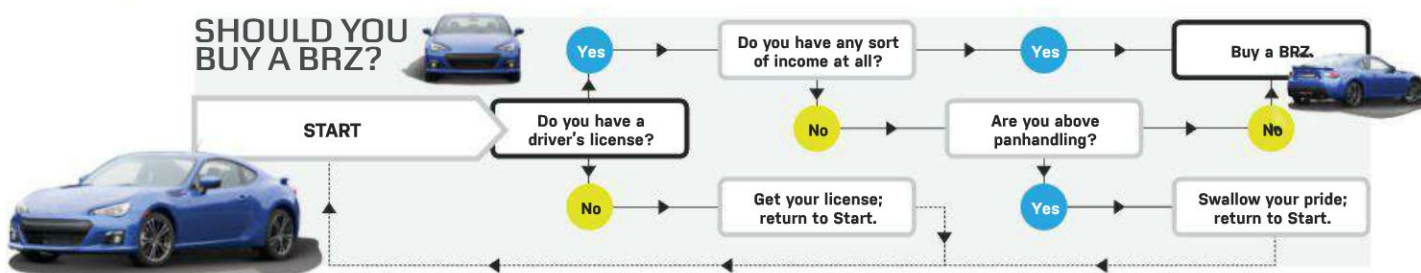
SUBARU BRZ/SCION FR-S / Base Price: \$26,245/\$24,930

▶ **Fun to Drive**

A curious thing happens after you drive the Subaru BRZ: You can't stop thinking about driving it again. When rumors first started swirling that Subaru and Toyota were working together on an affordable RWD sport coupe, the anticipation was immediate. And to everyone's delight, the BRZ exceeded all expectations. Largely engineered by Subaru and styled by Toyota, the BRZ—and its sister car, the Scion FR-S—shares some suspension components with the Impreza, but those bits were modified. The car is virtually all-new. So is the engine, a Subaru 2.0-liter flat-four that musters 200 hp and 150 lb-ft of torque. That might not sound like enough oomph for a sports car, but slide behind the BRZ's wheel, down into the bolstered seats, and push the pedal. Within a few miles, you'll realize that this is the perfect amount of power to match the car's talents and dainty 2762-pound curb weight. The BRZ handles like it's your personal road therapist, intuiting your every thought while supplying plenty of feedback along the way. The gearbox and transmission operate with the precision of a Swiss watch, and that fat steering wheel is just what your hands want. Cost-cutting measures have been taken, but the car doesn't feel cheap. Instead it feels light and toned like a bantamweight boxer, ready to take on whatever the road throws at it. For the price, more fun on four wheels doesn't exist.


 AUTO INTEL

SHOULD YOU BUY A BRZ?





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SPECS
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Independent strut/
multilink, coil
spring

14.6-inch disc/14.4-
inch disc

P285/35ZR20;
P305/35ZR20



AUTO INTEL



The ZL1 delivers a blistering 0 to 60-mph time and enough stopping power to shoot you through the windshield. But where it shines brightest is driving capability. The active suspension management system provides outstanding cornering and steering feedback, enabling this monster to go very fast in all lines—straight and curvy. — BEN WOJDYLA, ASSOCIATE EDITOR, AUTOMOTIVE



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The Volkswagen Touareg comes with an available panoramic sunroof. And an available 8" navigation screen with 3D landmarks. And a remote rear liftgate. And 4MOTION® all-wheel drive. And Bluetooth® with audio streaming. In fact, the Touareg comes with more Volkswagen than any Volkswagen we've ever built. It's the best of everything we've perfected. **That's the Power of German Engineering.**



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2013 AUTOMOTIVE EXCELLENCE AWARDS

RAM 1500 / Base Price: \$23,585

▶ **Hauling**

○ Ram perennially takes the bronze in full-size pickup sales, but the 2013 1500 could change all that. When Chrysler made Ram a separate brand from Dodge in 2010, the first order of business was upgrading the nameplate's core pickup. For 2013 the list of comprehensive updates makes it essentially an all-new truck. The new 1500 features a host of structural improvements and fuel-saving technologies but still remains very much a workhorse. When equipped with the V-6 the 4x4 Tradesman model's max towing capability is 6300 pounds, and it bumps up to 9000 pounds with the V-8. The latter is a 100-pound improvement on the 2012's max towing. All brawn and no brains isn't an option for a modern pickup, though, so the Ram also comes with a smart-looking cabin and the complete raft of Chrysler infotainment and safety system options, including an 8.4-inch touchscreen, Chrysler's next-generation UConnect system, a Wi-Fi hotspot, a rearview camera, and rear parking sensors. The result is a more capable, powerful, fuel-efficient, and all-around user-friendly truck.

THE 1500'S REDESIGNED SKIN LOOKS FAMILIAR, BUT IT NOW HAS A DRAG COEFFICIENT OF 0.36. THAT'S SLIPPERY FOR A TRUCK.

CHASING EVERY MPG, THE 1500 COMES STANDARD WITH LOW-ROLLING-RESISTANCE TIRES.

**GRILLE SHUTTERS**

The shutters behind the grille automatically open when the engine needs cooling or close to decrease aerodynamic drag.

**ENGINE AND TRANSMISSION**

A new high-tech 3.6-liter Pentastar V-6 offers 305 hp, 269 lb-ft of torque, and 20 percent better efficiency than the outgoing V-6. The much-loved 5.7-liter Hemi V-8 gets a 12-hp bump. New eight-speed automatic transmissions provide smoother shifts and keep the engines in their most efficient rev ranges. Also: a new rotary shifter knob.

**ELECTRIC STEERING**

Improves fuel efficiency 1.8 percent by reducing engine drag caused by hydraulic power steering. And it frees up an extra 5 hp for performance.

AUTO INTEL

**AIR SUSPENSION AND FRAME**

The new active air suspension varies ride height from 7.6 inches for high-speed aerodynamics to 10.7 inches for off-road clearance. It also manages load leveling and drops the truck when parked for easier entry. Ram's new frame features hydroforming and high-tensile steel to improve strength and torsional stiffness while decreasing weight.



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2013 AUTOMOTIVE EXCELLENCE AWARDS

CADILLAC ATS / Base Price: \$33,900

▶ **Luxury**

ZEE GERMANS

**Audi A4****Preis** \$33,395

Ja! Great price, great styling, great interior
Nein! FWD bias means handling disadvantage

**BMW 3 Series****Preis** \$37,395

Ja! RWD, handling, wonderful engines
Nein! Options get ya; expanding footprint

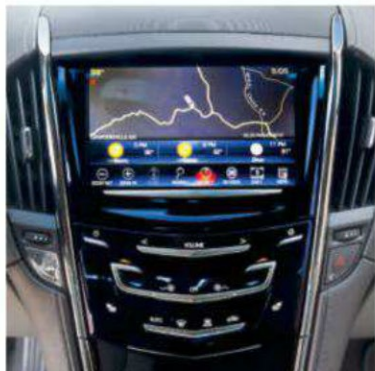
**Mercedes-Benz C-Class****Preis** \$36,255

Ja! RWD, luxury leader, high-tech
Nein! Least powerful; bit of a geezer's car



AUTO INTEL

Luxury isn't defined solely by the gleam and grain of the wood fastened to the dashboard or the suppleness of the hides stitched to the seat frames. Sure, we like to be pampered, but the luxury cars we truly admire are more like the all-new Cadillac ATS—short on fluff and long on substance. The ATS packs a technical spec sheet loaded with advanced lightweight materials in the chassis as well as a body shell that's up to 40 percent stiffer than the larger CTS sedan. It's a svelte machine, rolling across the scales in its most feathery form at just 3300 pounds. The ATS is the first Cadillac to fully assault the entry-level luxury sport sedan class long dominated by German brands. The verdict? When the ATS is equipped with its 321-hp V-6, top FE3 suspension, Magnetic Ride Control damping (just like the Corvette), and Brembo brakes, it can perform with as much poise and confidence as its rivals—perhaps more. Yes, it's that good. The interior also meets the refined standards of the Germans. We dig the CUE infotainment system with its iPhone-like multi-touch screen. Best of all, Cadillac delivers this substantial sedan for under \$35,000. That's one of the best luxury sport sedan deals of the year.



The interior of the ATS is handsome, with finely stitched leather, wood accents, and Cadillac's new CUE infotainment system.



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Anatomically cut thumb area of palm provides an exceptional fit



PADDED PALM

KNUCKLE PROTECTION

Lightly padded knuckle and index finger absorbs impacts

PADDED PALM

Anatomically designed palm padding increases dexterity and reduces vibration



IMPACT PRO

IMPACT PROTECTION

Impact Guard™ index finger with molded TPR for more dexterity when using hand tools

IMPACT PALM

Anatomically shaped padding for comfort and protection

Introducing Mechanix Wear's all-new high performance DIY glove line. No matter how long you've neglected that certain project on your list, these gloves are the perfect tools to help you tackle any task, big or small. Work faster, safer and cleaner®— all while having more power and control. Mechanix Gloves. The Tool That Fits Like a Glove.®



2013 AUTOMOTIVE EXCELLENCE AWARDS

SRT VIPER / Base Price: \$99,390

▶ **Design**

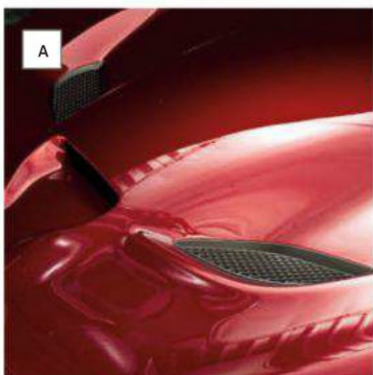
With its cartoonish silhouette and staggering performance numbers, the Dodge Viper is the epitome of the car-poster supermodel. Throughout its four generations, which began in 1992 and ended in 2010, four design elements came to define the car's shape—cab-rearward proportions, double-bubble roof, central air intake, and side gills. But for Ralph Gilles, Chrysler's senior vice president of design and CEO of its SRT performance subbrand, these elements never fully melded into one cohesive design. So when he got approval to make a new Viper, his team built it from the ground up. The SRT Viper advances the car's design, better blending the curvaceous sheet metal and increasing overall functionality. The only carryover from the old Viper? The windshield.

Air extractors alongside the central air intake reduce engine bay heat buildup and air pressure on the nose [A]. The lower air intake and vertical headlights mimic a snake's face [B]. A much-

needed interior upgrade [C]. Having the back cutout wrap around the sides exaggerates rear width [D]. The hatch, roof, and hood are made of carbon fiber [E]. Differential cooling ducts at the rear

of each window lengthen the tapered canopy to create a sense of motion [F]. Extra-wide side vents remove hot air from the engine bay; side exhausts are another Viper trademark [G].

AUTO INTEL



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THE NEW PATHFINDER
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(19 GROCERY BAGS)

260 hp; 3.5-liter DOHC V-6; CVT

mpg [city/hwy]: 20/26



New second-row folding system makes third-row access a cinch.

A storage box beneath the third row provides 2 extra cubic feet of cargo space.



*A whole lot of soccer balls.



By ditching the last-gen Pathfinder's body-on-frame design and optional V-8 for a sleeker unibody construction and a tidy V-6, Nissan made the Pathfinder into a fuel-efficient crossover that is more spacious and more practical all around.

— ANDREW DEL-COLLE, ASSOCIATE EDITOR



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BOSE
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2013 AUTOMOTIVE EXCELLENCE AWARDS

TESLA MODEL S / Base Price: \$49,900 (after rebate)

▶ **Technical Innovation**

How would you build a modern car if you didn't have to make space for an engine? That question is still a thought experiment for most of the auto industry, but California-based startup Tesla Motors has actually done it with the new Model S. With its motor packaged neatly between the rear wheels and its massive battery mounted under the vehicle floor, the Model S has lots of free space available under the hood, in the rear of the vehicle, and in the cabin for storage, legroom, and two extra passengers. Tesla has also reimagined the traditional center console as one enormous, reconfigurable 17-inch touchscreen. And if all that doesn't impress you, consider this: In its top-of-the-line Performance variant, the Model S does 0 to 60 in 4.4 seconds—that's BMW M5 territory.

SIMPLY SMART

SHELL

The body is a combination of high-strength steel and lightweight aluminum. Without an engine to absorb frontal impacts, the Model S relies on four extruded octagonal rails.

MOTOR

The 310-kw/416-hp electric motor is positioned in line with the rear axle, freeing up 5.3 cubic feet of space under the hood and room in the rear for storage and passengers.

SUSPENSION

The front suspension doesn't need to support an engine, so it's designed to be lightweight. Active air suspension lowers and raises the chassis for better aerodynamics.

BATTERY

The 85-kwh battery pack is the heaviest element of the car at roughly 1000 pounds. Mounting a flat battery below the cabin creates an extremely low center of gravity.



THE MODEL S HAS PLENTY OF STORAGE UP FRONT.



Almost all of the controls are consolidated into a 17-inch touchscreen. Retractable door handles reduce drag and are just plain nifty.



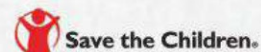
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2013 AUTOMOTIVE EXCELLENCE AWARDS

HYUNDAI ELANTRA GT / Base Price: \$19,170

▶ **Value**

Americans are finally downsizing their vehicles. Cars like the Hyundai Elantra are outselling trucks by 33 percent and SUVs by 55 percent as of August 2012. That wasn't the case a few short years ago. Modern compacts offer better fuel economy, power, and sophistication than their predecessors, and they do it for a great price. But of all the quality compacts currently available, most impressive is the new Elantra GT. The GT's practical, wagon-like hatchback was built primarily for Europe, so it's shorter than any other Elantra but packs a substantial 51-cubic-foot cargo hold when the seats are folded down. That's more than some larger wagons. Yet this hatch also shares some parts with Hyundai's sporty Veloster coupe, so when the road turns into a twisty ribbon of fun, the GT is a willing partner. Perhaps most interesting is that the GT is the first Hyundai to use the new Driver Selectable Steering Mode (DSSM). With an electric motor replacing the traditional hydraulic steering pump, engineers can preprogram the steering feel and effort. In the Elantra GT the DSSM provides three distinct modes: Comfort, Normal, and Sport. Although the steering rack's ratio remains constant, the DSSM system can alter the weight and torque buildup through the steering wheel and can also stiffen the on-center feel. That's a smart feature for a car that costs less than \$20,000.

AUTO INTEL



PRIUS C / Base Price: \$19,745

▶ **Fuel Efficiency**

Delivering an EPA-rated 53 mpg in the city, the Toyota Prius C is the most fuel-efficient compact car in America. Although the C uses much of the regular Prius's tech, it does so in a lighter weight, more compact footprint based on the Toyota Yaris. The drivetrain is a clever setup, consisting of a 1.5-liter four-cylinder paired with an electric motor, CVT, and batteries. The engine revs only to 4500 rpm, but then the electric motor kicks in to provide any extra power. Topping out at 99 hp, the C isn't a dragster, but it's not supposed to be. The interior is also designed with light weight and cost in mind, which is to say it's thrifty rather than cheap. In the top level trim, Toyota uses something called SofTex, an imitation leather that weighs half as much as the real thing. True, it can take time to make back in fuel savings whatever extra cash you spent on a hybrid car, but the C's lowish price point, overall quality, and real-world efficiency make it a smart all-around purchase.

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Cold Weather Starts



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The truth is your car's engine can have as much trouble starting in freezing temperatures as you do waking up to a frosty winter morning. And for a car, cold weather starts can be unsafe. Most engine wear occurs in the moments after a cold start when conventional engine oil is thick and fails to quickly lubricate critical engine components. And, heavier oil grades will slow the movement of engine parts and make starts more difficult.

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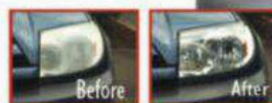
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Stuck in the Ice

BY KALEE
THOMPSON

WITH ARCTIC SEAGOING TRAFFIC GROWING FAST, THE U.S. HAS BEEN PAINFULLY SLOW TO BUILD ITS FLEET OF MUCH-NEEDED ICEBREAKERS. 

When the heavy-duty icebreaker *Polar Star* pulls away from the Coast Guard pier in Seattle this month, it will mark the first time the 36-year-old ship has left port in more than six years. With rebuilt engines, a revamped propeller system, and three new cranes, the *Polar Star* is emerging from a \$60 million renovation intended to extend its operational life by seven to 10 years.

Several months will be devoted to sea trials. Then, next fall, the ship will embark for the annual resupply of Antarctica's McMurdo science station, a job that has been outsourced to leased Russian and Swedish ships for the past six years. Until a few years ago, the U.S. had two icebreakers capable of tackling such thick ice: the *Polar Star* and its sister ship, the *Polar Sea*. Both were commissioned in the 1970s, with an expected life span of 30 years. In 2006 budget cuts forced the *Polar Star* into a soft retirement. Then, in 2010, the *Polar Sea* suffered a catastrophic engine failure. The crippled ship was laid up in Seattle, its parts soon cannibalized as *Polar Star* replacements and spares. Today the *Polar Sea* is in "inactive" status, most likely destined for the scrap yard.

The U.S. is now in a crisis of icebreaking capability. Though the outsourced McMurdo mission has been a blow to American pride, the much more dangerous shortcoming is in the Arctic, which this year saw the smallest expanse of summer sea ice since satellite records have been kept. Retired Coast Guard Rear Adm. Jeffrey Garrett, former captain of three icebreakers,

worries about the depletion of the U.S. fleet just as northern waters are opening up. "There is less ice, which is permitting a lot more human activity in a whole bunch of different arenas—oil and gas exploration, tourist ships, commercial ships," he says. In the 1980s one or two ships attempted to maneuver through the Northwest Passage each summer season. In 2011 more than 30 ships navigated the world's northernmost waters, some of them tankers carrying multimillion-gallon loads of oil and natural gas. This fall Shell Oil began drilling exploratory shallow-water wells off the Alaskan coast.

There's no question that climate change is ushering in a busier, more politically contentious, and environmentally vulnerable Arctic. And it's just as clear that the U.S. is not ready for that future. For



How to Outsmart a Millionaire

Only the "Robin Hood of Watchmakers" can steal the spotlight from a luxury legend for under \$200!

I wasn't looking for trouble. I sat in a café, sipping my Espresso and enjoying the quiet. Then it got noisy. Mr. Bigshot rolled up in a roaring high-performance Italian sports car, dropping attitude like his \$22,000 watch made it okay for him to be rude. That's when I decided to roll up my sleeves and teach him a lesson.

"Nice watch," I said, pointing to his and holding up mine. He nodded like we belonged to the same club. We did, but he literally paid 100 times more for his membership. Bigshot bragged about his five-figure purchase, a luxury heavyweight from the titan of high-priced timepieces. I told him that mine was the **Stauer Corso, a 27-jewel automatic classic now available for only \$179**. And just like that, the man was at a loss for words.

Think of Stauer as the "Robin Hood of Watchmakers." We believe everyone deserves a watch of uncompromising precision, impressive performance and the most elegant styling. You deserve a watch that can hold its own against the luxury classics for a fraction of the price. You'll feel the quality as soon as you put it on your wrist. This is an expertly-crafted time machine... not a cry for attention.

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the past two years the U.S. has had just one operational ocean-going icebreaker, the medium-duty *Healy*. “The polar icebreakers were designed as heavy icebreakers that can do a little bit of science. The *Healy* was designed as a scientific research ship that can break a little bit of ice,” says *Polar Star* Capt. George Pellissier. Last year the *Healy* was diverted from a scientific mission to break a passage into Nome, Alaska. The remote Inuit community had missed its prewinter shipment of heating and vehicle fuel due to a massive storm—known locally as a blizzard. Cutting an ice passage to and from the village took the *Healy* well over a month. It was a job better suited to a more powerful ship. “This country led the world in the development of modern icebreakers,” Garrett says. “Back in the ’60s we had eight of them.”

Even with the *Polar Star* once again in operation, a two-ship fleet of one medium and one heavy icebreaker is not enough to maintain

an effective presence near both poles. If the U.S. is a reluctant Arctic power, other countries are ready to step into the role. Russia, which in 2007 sent two manned submarines to drop a titanium capsule containing a flag on the seabed at the North Pole, is anticipating that the northern sea route will become as important to global shipping as the Suez Canal and has already announced a fleet of four new nuclear-powered icebreakers. China’s first icebreaker began its maiden voyage this July. A second Chinese ship, a polar research vessel, is due to enter service in 2014.

Beefed-up search-and-rescue capabilities in the far north have been on the Coast Guard’s agenda for years, and for the past several summers Coasties have been experimenting with a temporary outpost near Barrow, Alaska, the northernmost U.S. settlement. They’ve discovered that building a permanent base would be a massively expensive engineering project. There are no roads connecting Arctic Alaska to the more populated part of the state, and no natural harbors north of Nome. Permafrost underlies everything, and that permafrost is melting.

There may be a better option. “If you’ve got an icebreaker that can carry two helicopters, has a heavy-lift crane, has cargo space—spots on deck for carrying standard containers—has a command-and-control communications facility, it can be your floating base,” Garrett says. With a heavy-lift davit system, such a ship could carry the Coast Guard’s standard 47-foot surfboats, which can handle heavy weather and be used to conduct missions of up to 24 hours. The ship could act as a platform to respond to an oil spill, rescue passengers from a foundering tourist or research vessel, and conduct law-enforcement missions. Such a role could be played by the *Polar Star*, which can hangar two helicopters.

Given that designing, building, and commissioning such ships takes nearly a decade, the commitment to build more is already overdue. There are only four or five shipyards in the U.S. capable of building heavy icebreakers, whose thick steel and tight framing make them inherently more expensive than other ships of the same size. More efficient engines could allow new vessels to operate with lower horsepower, even while maintaining equivalent icebreaking capability, and they could run on cleaner liquefied natural gas. A new ship may also be built with rotating thrusters instead of traditional propellers, improving maneuverability.

Last February, Washington took a step in the right direction, allocating \$8 million to survey and design a new polar icebreaker. A fully equipped ship will cost about \$850 million. That cost is high. But the cost of inaction? Of risking impotence in the face of the first major catastrophe in the evolving Arctic? That cost is sure to be much higher. **PopMech**

WORLD'S KEY OCEANGOING ICEBREAKING FLEETS

Most of the world’s icebreaker fleets are expanding and modernizing to extend Arctic navigation into the spring and fall, provide access to offshore resources, and keep subarctic icy waters navigable. Russia has the largest fleet and plans to add at least four more vessels, including one that can smash ice more than 13 feet thick. The U.S. has two ships [the more powerful one can break ice up to 6 feet thick], and none in the pipeline.

50 YEARS OF VICTORY Most Powerful in Russian Fleet				VS	POLAR STAR Most Powerful in U.S. Fleet			
								
Length				524 feet	Length			
Power (nuclear)				75,000 hp	Power (diesel/electric, gas)			
Icebreaking capacity				9.2 feet	Icebreaking capacity			
Commissioned				2007	Commissioned			

COUNTRY	Russia	Finland	Sweden	Canada	Denmark	USA	China, Germany, Norway
FLEET	32	8	7	6	4	2	1
STATUS	A new nuclear-powered breaker due in 2017 will be the world's most powerful with over 80,000 hp.	The smallest of its aging fleet, the <i>Voima</i> , is the oldest active icebreaker in the world, entering service in 1954.	The <i>Oden</i> and the <i>Vidar Viking</i> were the first nonnuclear surface vessels to reach the North Pole.	Slated for service in 2017, the <i>John G. Diefenbaker</i> will be Canada's largest flagged icebreaker at 459 feet.	Since 2011 the Danes have flagged four new icebreakers for duty on the Baltic Sea.	The <i>Polar Star</i> can handle thick ice; the <i>Healy</i> isn't designed for constant Arctic use.	All three nations are developing polar research vessels, with China's second ship set to enter service as early as 2014.



THE NAME OF THE GAME

When the 2013 Honda Accord arrived this fall, it marked 30 years of auto manufacturing in the United States¹

Over those 30 years, competing in the industry's most hotly contested segment, the name Accord has rested perennially near the top of the sales rankings and collected numerous awards.

The 2013 model, the most refined and technically advanced ever, wears the Accord name proudly while amplifying the values of its heritage. Both Sedan and Coupe benefit from a svelte redesign that manages the neat trick of being slightly smaller outside, for enhanced maneuverability and fuel-saving weight control, while adding space inside: there's more legroom and headroom

in the rear seat, and more shoulder room for all. The new Accord employs ACE™ II, a Honda-exclusive body structure engineered to distribute frontal crash energy more effectively, even in small overlap frontal crashes.

The sophisticated design carries over to a cabin that's more comfortable and loaded with features to make driving an Accord easier, more enjoyable and confidence-inspiring. Standard equipment includes dual-zone climate control, an 8-inch intelligent-multi-information display (i-MID), an audio system with Pandora² radio and Bluetooth®³ HandsFreeLink®, Bluetooth®³ Streaming Audio,



Accord

1. Honda vehicles are manufactured using domestic and globally sourced parts.

At the heart of every Honda is one of its famous smooth, quiet and efficient engines

SMS text message function⁴, a rearview camera, a tilting and telescoping steering column, automatic projector-beam halogen headlights and active noise canceling. Most competitors charge extra for these features. EX models add power moonroof and keyless entry. There's more equipment available, of course, including advanced technology like Forward Collision Warning⁵, Lane Departure Warning⁶ and Honda LaneWatch™⁷; a passenger-side, mirror-mounted camera that displays more of what's beside and behind the car on the i-MID; a 10-way power adjustable seat; heated seats; touch-screen audio controls; and satellite-linked navigation⁸ with voice controls and traffic information.

At the heart of every Honda is one of its famous smooth, quiet and efficient engines, and the 2013 Accord ups the ante with both four-cylinder and V-6 powerplants that use less fuel while making more power. The new Earth Dreams 2.4-liter i-VTEC now employs direct-injection for improved fuel combustion⁹. This efficient technology propelled Dario Franchitti to victory lane at the 2012 Indianapolis 500; it pays off on the road with 185 hp (up 8 from last year) and 181 lbs-ft of torque (up 20), while earning a 36 mpg highway fuel economy rating⁹ in Accords equipped with CVT. An Eco Assist feature helps drivers make the most of every gallon—press the ECON button to automatically adjust fuel-consuming systems to help maximize their fuel



Step up to the 3.5-liter V-6 for 278 horsepower and a torque curve with enhanced low-rpm response

efficiency. Need performance? Press it again. Coaching bars on either side of the speedometer help, changing from white to green to indicate better fuel efficiency⁹.

Accord offers a six-speed manual transmission for those who want to be more engaged, and a Sport model with 18-inch wheels, fog lamps, a decklid spoiler and less restrictive exhaust to free up a bit more power (189 hp, 182 lbs-ft). A Sport with CVT includes new paddle-shifters.

Step up to the available 3.5-liter V-6 for 278 horsepower and a torque curve with enhanced low-rpm response. In Accords with the six-speed automatic transmission, the V-6 uses Variable Cylinder Management (VCM) to improve fuel efficiency⁹ by shutting off some cylinders when full power is not needed. A six-speed manual can be had in V-6 Coupes.



8-inch intelligent-multi-information display (i-MID), audio system





All 2013 Accords are built in Ohio, marking 30 years of Honda's ever-expanding participation in the U.S. economy.

In the EX Coupe and EX-L Sedan (or higher trim levels), HondaLink™ featuring Aha¹⁰ brings access through a compatible smart phone to news, information, social media updates, personalized searches, Internet radio, audiobooks and more, all provided through the Accord's audio system. In the top-level Touring Sedan, adaptive cruise control adjusts speed depending on distance to a car detected ahead.

All 2013 Accords are built in Ohio, marking 30 years of Honda's ever-expanding participation in the U.S. economy. A skilled workforce and world-class techniques have earned the Marysville, OH, plant (northwest of Columbus) a reputation for quality construction and hands-on craftsmanship. Honda now has 16 design, research and development facilities in North America and nine manufacturing plants with capacity to build 9.9 million vehicles, parts, components and other products. It pioneered with U.S.-built engines

(1986) and transmissions (1989). Accord's new CVT warranted another \$274 million investment (bringing the total to \$12.3 billion in U.S. capital investment), and added 150 jobs to the nearly 26,000 Honda associates in the United States. Just in the past two years, the company has announced \$2 billion in fresh investments and 1,590 jobs. The firm also draws on more than 500 suppliers in 34 states. Today, 85 percent of all Hondas and Acuras sold here are built in North America—the highest percentage for any international automaker.

Honda, in other words, has a name to protect and a record—like that of Accord—of staying true to itself.

Accord

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7. Display accuracy will vary based on weather, size of object and speed, and the display may not show all relevant traffic. The display is not a substitute for your own direct visual assessment of traffic conditions before changing lanes.

8. The Honda Satellite-Linked Navigation System is available on EX-L and

standard on Touring models in the United States, Canada and Puerto Rico (FM Traffic service only available in the United States, except Alaska). Please see your Honda dealer for details.

9. 24 city/34 highway/28 combined mpg rating for 4-cylinder 6MT models. 27 city/36 highway/30 combined mpg rating for Sedan CVT models. 26 city/35 highway/29 combined mpg rating for Sport Sedan and 4-cylinder Coupe models with CVT. 21 city/34 highway/25 combined mpg rating for V-6 Sedan models. 18 city/28 highway/22 combined mpg rating for V-6 Coupe 6MT models. 21 city/32 highway/25 combined mpg rating for V-6 Coupe 6AT models. Based on 2013 EPA mileage ratings. Use for comparison purposes only. Your actual mileage will vary depending on how you drive and maintain your vehicle.

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POPULAR MECHANICS SPECIAL

the world of Tomorrow

BY THE EDITORS

IT'S NEVER EASY TO PREDICT THE FUTURE, BUT AS PM'S 110TH ANNIVERSARY CELEBRATION DRAWS TO A CLOSE, WE'VE DECIDED TO GIVE IT A TRY (WITH A LITTLE HELP FROM SOME VERY SMART FRIENDS).

HERE ARE 110 AMBITIOUS IDEAS FOR THE DECADES AHEAD.

Almost every day somebody posts the following on Twitter or Facebook: "In 1949, forecasting the relentless march of science, POPULAR MECHANICS said, 'Computers in the future may weigh no more than 1.5 tons.'"

It is one of those quotations—often plucked from online lists of similar nuggets—that people like to circulate as a pleasant reminder of how much smarter they are than those who lived before them.

The actual quotation, from the March 1949 issue of POPULAR MECHANICS, goes like this: "Where a calculator like ENIAC today is equipped with 18,000 vacuum tubes and weighs 30 tons, computers in the future may have

PHOTOGRAPHS BY CHRISTOPHER GRIFFITH
MODELS BY MEGAN CAPONETTO

only 1000 vacuum tubes and perhaps weigh only 1½ tons.”

It reads a bit differently in context, no? Written at the time when computers were still huge mechanical/electrical contraptions, the article provided a pretty solid overview of the infant technology. Of course, what the article did not anticipate were two of the most pivotal inventions in human history: the transistor, which came into widespread use in the mid-1950s, and the integrated circuit, or microchip, which intensified the march toward miniaturization a decade later. The first fully transistorized computer, the IBM 608, hit the market in late 1957.

It weighed 1.2 tons.

And therein lies the dilemma for anyone who dares speculate about the future. Even if you're accurate in the near term—and PM's 1949 story was a respectable piece of prognostication—a prediction can begin to look naive or ridiculous when viewed a generation or two later. But we don't let that stop us. As a magazine about science and engineering, it's our job to explain how technologies just now coming into view might shape the future.

In preparing this 110th anniversary issue of POPULAR MECHANICS, I've spent a lot of time leafing through our archives. It's pretty inspiring to see how well the magazine anticipated crucial turning points in technology—the impact of the automobile, the rise of mass aviation, the space program. In a 1932 article, Winston Churchill predicted a combination of telephone and television that sounds a lot like today's Internet. And when the Internet era finally did dawn, PM devoted a 1994 cover story to this new “Information Superhighway,” calling it “the greatest social revolution since the automobile.” Yep, that sounds about right.

One of my favorite articles was written by science writer Waldemar Kaempffert and published in 1950. Entitled “Miracles You'll See in the Next Fifty Years,” the piece showed remarkable prescience, predicting the interstate highway system, automated factories, weather-forecasting supercomputers, and medical imaging devices similar to modern CAT scans. But Kaempffert's misses were as interesting as his hits. He envisioned a future in which “rich people in a hurry” would fly in 1000-mile-per-hour rocket planes, while ordinary folks would commute in the “family helicopter.”

Sorry to disappoint you, dear readers, but we're still waiting on those. Here's the problem: just because something is *possible* does not mean it is inevitable. Building a supersonic passenger jet (though not a rocket) became feasible in the late 20th century—and the Concorde really did cruise at Mach 2, or more than 1300 mph. But the high-speed fuel guzzler never made money, and it was finally pulled from service in 2003. Similarly, those personal helicopters (the subject of much hopeful conjecture in PM over the years) would be simple enough to build. But there is no simple way to fit millions of new aircraft into our urban skies—and the very idea injects new terror into the phrase “learner's permit.”

One of the most fascinating things in the Kaempffert article is his depiction of domestic life circa 2000: Homes are built of metal and plastic; dishes, sheets, and clothing are all disposable; and, to clean up, the homemaker “simply turns the hose on everything.” Even food would be synthesized from sawdust and wood chips and delivered to the home in frozen blocks.

It was a logical expectation. Midcentury America quickly embraced novelties such as polyester clothing, frozen TV dinners, and labor-saving dishwashers. Why wouldn't such trends continue indefinitely? Well, it turns out that while we all

MEET THE PM BRAIN TRUST

It takes a lot of brainpower to map out the future. To make sure we had an abundant supply, we assembled a team of experts—fondly known as the PM Brain Trust—to help us with this story. In addition to completing a 41-question survey, they shared their comments. In the following pages, you'll find 15 of their predictions. Before we move on, let us thank them each by name.

In this March 1949 story, we shrewdly forecast the dawn of the 1.5-ton computer.



appreciate convenience, we also like a good home-cooked meal once in a while. Most Americans still walk on wood floors, wear cotton and wool clothing, and cook food that their great-grandparents would find quite familiar. One of the biggest challenges in forecasting the future isn't understanding technology, it's understanding people—and people don't have an unlimited appetite for change.

Perhaps the trickiest part of making predictions is getting the timing right. Some advances are slowed by social inertia or economic impracticality. Others suddenly leap ahead as a result of a technological breakthrough such as the microchip.

In making the 110 predictions in this special issue, we tried to balance our deep-rooted techno-optimism with some hardheaded skepticism. We turned to scores of experts—scientists, engineers, and many longtime PM contributors and consultants—to help us sketch the rough shape of the next century. We canvassed our experts about the nature of future changes and when key breakthroughs might occur. How did we do? There's only one way to know for sure: Check back with us in 110 years.

→

Jim Meigs
JAMES B. MEIGS
EDITOR-IN-CHIEF

Michael Belfiore
Journalist/author,
Rocketeers

Karen J. Brewer
Chemistry
professor,
Virginia Tech

Shawn Carlson
Founder, Society
for Amateur
Scientists

Sean Carroll
Theoretical
physicist, Caltech

David E. Cole
Chairman emeritus,
Center for
Automotive
Research

George Davison
CEO and founder,
Davison Intl.

Esther Dyson
Entrepreneur

Shawn Frayne
Inventor/president,
Humdinger
Wind Energy

Stuart Harshbarger
Co-founder and
chief technology
officer, Contineo
Robotics LLC

Jamie Hyneman
Host, MythBusters

Thomas D. Jones
NASA astronaut
and planetary
scientist

Dr. Ken Kamler
Microsurgeon
and director,

The Explorers Club

John Maeda
President,
Rhode Island
School of Design

Annalee Newitz
Editor-in-chief,
io9.com

Michael Ravine
Advanced projects
manager, Malin
Space Science
Systems

**Glenn Harlan
Reynolds**
Law professor,
University of
Tennessee and
author, Instapundit

Adam Savage
Host, MythBusters

Gavin A. Schmidt
Climatologist, NASA
Goddard Institute
for Space Studies

Seth Shostak
Senior astronomer,

SETI Institute

Steven D. Weiner
Director of
engineering
sciences,
Sikorsky Aircraft
Corp.

Daniel H. Wilson
Roboticist
and author,
Robocalypse

Jeff Wise
Author,
Extreme Fear

around the corner

2012-2022

MAKE WAY FOR DIGITAL SCROLLS, ROBOTIC
TRAINERS, AND SELF-REPAIRING BRIDGES.



■ People will be fluent in every language. With DARPA and Google racing to perfect instant translation, it won't be long until your cell-phone speaks Swahili on your behalf.

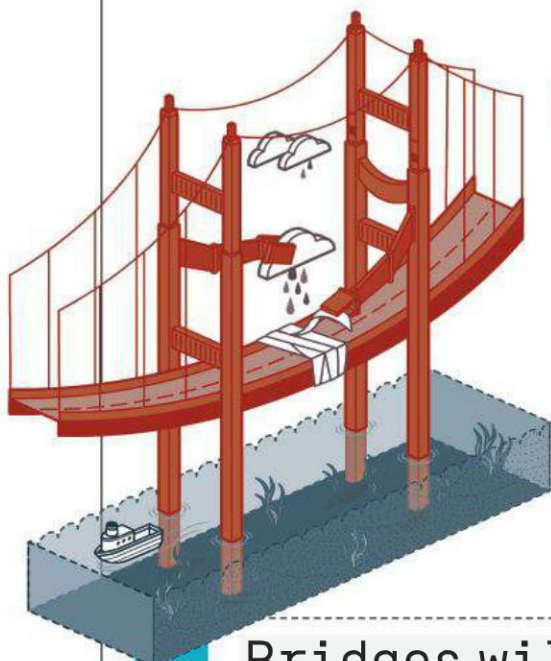
■ **Software will predict traffic jams before they occur.** Using archived data, roadside sensors, and GPS, IBM has come up with a modeling program that anticipates bumper-to-bumper congestion a full hour before it begins. Better yet, the idea proved successful in early tests—even on the Jersey Turnpike.

■ **Climate-controlled jackets will protect soldiers from extreme heat and cold.** The secret to all-weather clothing, according to former MIT student Kranthi Vistakula, is Peltier plates, which can be used to warm you up or cool you down by sending an electric current across the junction between two different metals. U.S. soldiers have put the lightweight tech to the test. So have soldiers in India. Based on early reviews, it won't be long until others enlist.

■ **Nanoparticles will make chemotherapy far more effective.** By delivering tiny doses of cisplatin and docetaxel right to cancerous cells, the mini messengers will significantly reduce the pain and side effects of today's treatments.

■ **Electric cars will roam [some] highways.** Who says you can't road-trip in a Tesla? In a few years, the 1350-mile stretch of Interstate 5 spanning Washington, Oregon, and California will be lined with fast-charging stations—each no more than 60 miles apart. In some areas you will find stations to the east and west too. Don't get any bright ideas, though. If you try to cross the country, you won't get much farther than Tucson.

■ **Athletes will employ robotic trainers.** Picture a rotor-propelled drone that tracks a pattern on your T-shirt with an onboard camera. Now imagine it flying in front of you at world-record pace. That's just the start—a simple concept developed by researchers in Australia.



Bridges will repair themselves with self-healing concrete.

Invented by University of Michigan engineer Victor Li, the new composite is laced with microfibers that bend without breaking. Hairline fractures mend themselves within days when calcium ions in the mix react with rainwater and carbon dioxide to create a calcium carbonate patch.

THE PM BRAIN TRUST SAYS:

WITHIN 20 YEARS

Self-driving cars will hit the mainstream market.

Battles will be waged without direct human participation (think robots or unmanned aerial vehicles).

WITHIN 30 YEARS

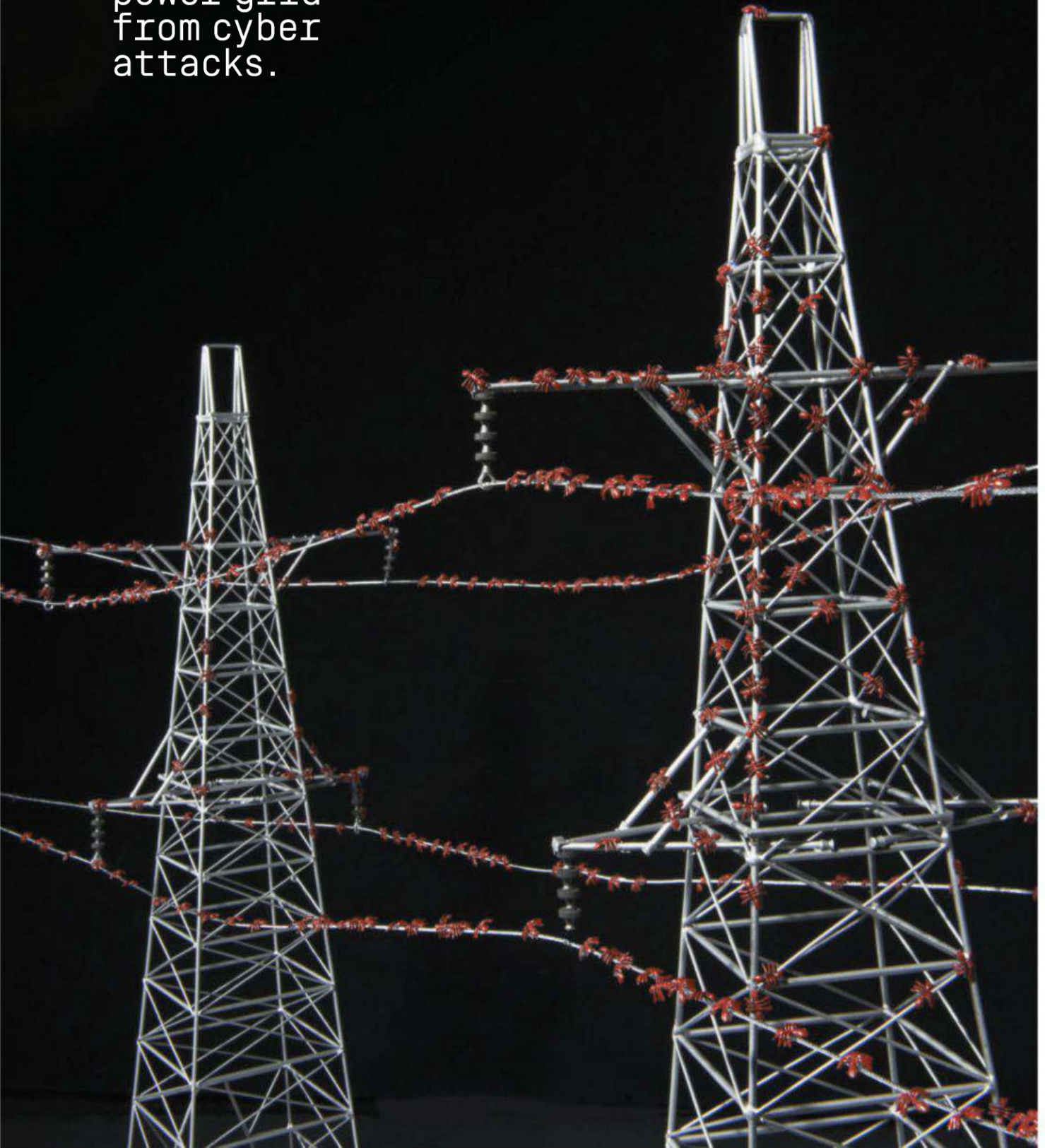
All-purpose robots will help us with household chores. Space travel will become as affordable as a round-the-world plane ticket.

WITHIN 50 YEARS

We will have a colony on Mars.

Digital
"ants" will
protect
the U.S.
power grid
from cyber
attacks.

Programmed to wander networks in search of threats, the high-tech sleuths in this software, developed by Wake Forest University security expert Errin Fulp, leave behind a digital trail modeled after the scent streams of their real-life cousins. When a digital ant designed to perform a task spots a problem, others rush to the location to do their own analysis. If operators see a swarm, they know there's trouble.



EXCEPTIONALLY LIGHT READING

SCROLLS WILL REPLACE TABLETS

Researchers have already reproduced words and images on thin plastic digital displays. If they want those displays to compete with the iPad, they need to fine-tune the color and refine the screens so you can put your feet up and watch LeBron throw down on YouTube.



YOUR CAR WILL BE TRULY CONNECTED

- › It will communicate with traffic lights to improve traffic flow.
- › It will interact with other vehicles to prevent accidents.
- › It will let you drag and drop a playlist from your home network.
- › It will find the gas station with the deepest discount and handle the payment.
- › It will notify you when someone dents your door and supply footage of the incident.

INTERPLANETARY PREP WORK

As we branch out as a species, it's quite other planets to print habitats for humans — Dave Evans, chief technology officer and

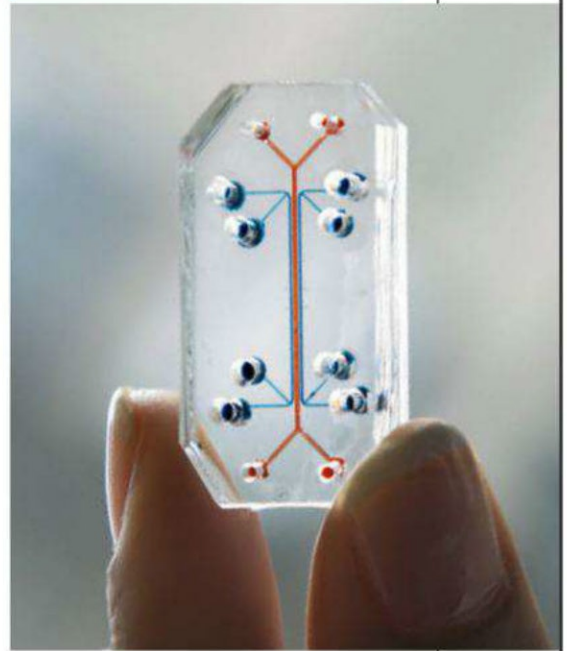
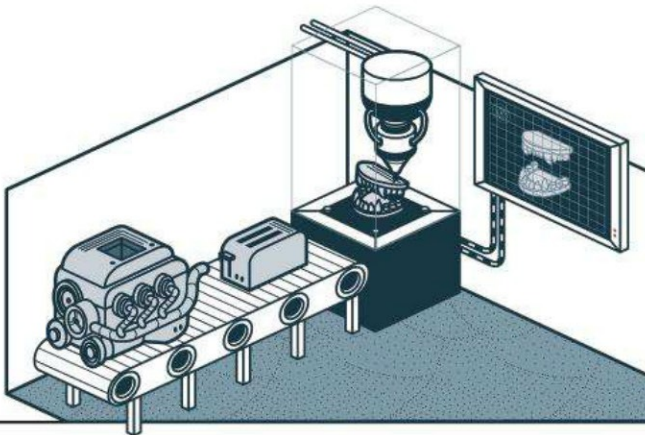
Your genome will be sequenced before you are born.

Researchers led by Jay Shendure of the University of Washington recently reconstructed the genome of a fetus using saliva from the father and a blood sample from the mother (which yielded free-floating DNA from the child). Blood from the umbilical cord later confirmed that the sequencing was 98 percent accurate. Once the price declines, this procedure will allow us to do noninvasive prenatal testing.



■ **Radiation sickness will be cured by injection.** Thanks to interest from the Department of Defense, several treatment options are now vying for FDA approval. In clinical trials, one of them, Ex-Rad, has not only prevented long-term cell damage but also promoted bone marrow recovery.

■ **That car part you need will be sculpted inside a 3D printer.** Dentists are already using this modern tech wonder to transform laser scans of your mouth into custom-fit appliances for your teeth. But that's a fraction of what the machine can do. When a 3D printer costs the same as, say, an HDTV, you will use one of your own to download all sorts of useful things, marveling as it creates each item layer by layer from plastic, rubber, titanium—you name it. Just imagine your future self printing a birthday cake, a Rolex, or a catalytic converter for the car. In time you'll even be able to download prescription medicine.



■ **Drugs will be tested on "organ chips" that mimic the human body.** Now undergoing trials in 15 research institutions, the new silicon chips feature channels that house living kidney or lung cells, above. Simulated blood and oxygen flow allows them to mirror the actions of real organs, reducing the need for animal testing and speeding up drug development—in the midst of a pandemic, that would be crucial.

■ **Passwords will be obsolete.** IBM says it will happen in five years. Who are we to disagree?

PHOTOGRAPH BY WYSS INSTITUTE (CHIP)

reasonable to think that we'll send 3D printers to prior to our arrival.
resident futurist, Cisco Systems



Apple and Google are designing face-recognition software for cellphones. DARPA is researching the dynamics of keystrokes. Others are looking into retinal scans, voiceprints, and heartbeats. The big question, it seems, is what will you do with all that time you used to spend dreaming up new ways to say JZRulz24/7!

■ **Car tires will be brewed by bacteria.** Isoprene—a key ingredient in rubber—is produced naturally by many plants but not at great enough volume to keep pace with the world's demand for tires. It can also be extracted from oil. But biotech firm Genencor has engineered *E. coli* microbes that produce gobs of the stuff as a by-product of metabolizing plant sugars. Goodyear, a partner in the study, is already testing prototypes of these bio-isoprene tires.

■ **Self-cleaning buildings will help us fight smog.** When sunlight strikes their aluminum skin, a titanium dioxide coating releases free radicals, which break down the grime and convert toxic nitrogen oxide molecules in the air into a harmless nitrate. Everything washes away in the rain.

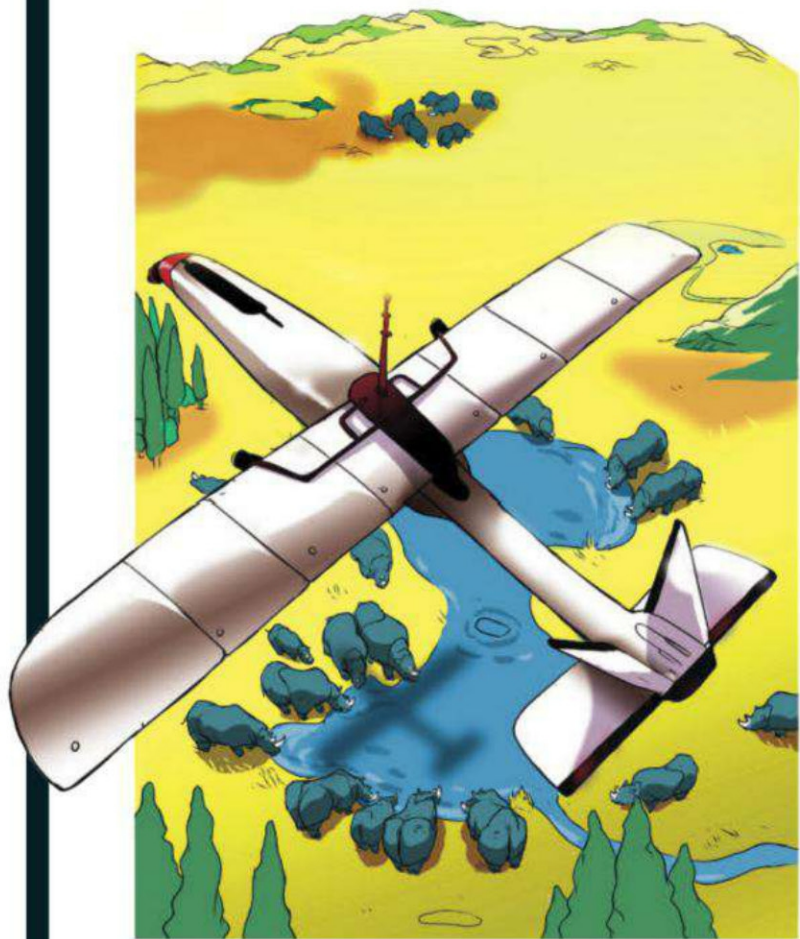
■ **Your clothes will clean themselves too.** Engineers in China have developed a titanium dioxide coating that helps cotton shed stains and eliminate odor-producing bacteria. To revive your lucky shirt after a night of poker, you need only step into the sun.



CALL IT A WILD IDEA

DRONES WILL PROTECT ENDANGERED SPECIES

Guarding at-risk animals from poachers with foot patrols is expensive and dangerous. This summer rangers in Nepal's Chitwan National Park previewed a savvy solution: Hand-launched drones armed with cameras and GPS provided aerial surveillance of threatened Indian rhinos.



BYTE SIZE

Data will be measured in zettabytes.

According to the International Data Corporation, the volume of digital content created on the planet in 2010 exceeded a zettabyte for the first time in history. By the end of this year, the annual figure will have reached 2.7 zettabytes. What exactly does a zettabyte look like? Well, if each byte were a grain of sand, the sum total would allow you to build 400 Hoover Dams.

Rescuers
will use
electronic
noses to
locate
disaster
victims.

Some devices will use an array of sensors to rapidly detect carbon dioxide, ammonia, and acetone released into the rubble via breath, sweat, and skin. Others sniff out chemical compounds from human remains buried 3 feet underground. All keep working long after the dogs have retired to their kennels.



■ **Genetic testing will be used to halt epidemics.**

A year ago, investigators at the National Human Genome Research Institute teamed with doctors in Maryland to track the outbreak of a deadly bacterial infection. The big breakthrough? Real-time genome sequencing, which helped them identify minute mutations in the microbe, determine how it spread, and quickly stop it.

■ **Vaccines will wipe out drug addiction.** The human immune system is supremely adept at detecting and neutralizing foreign substances. Why not train it to target illicit ones? That's the idea behind addiction vaccines: Persuade the body to produce antibodies that shut down drug molecules before they get to the brain. The concept works in mice. Human trials are under way.

■ **Smart homes will itemize electric, water, and gas bills by fixture and appliance.** Shwetak Patel, a 30-year-old MacArthur Fellow, is working on low-cost sensors that monitor electrical variations in power lines to detect each appliance's signature. He has already used pressure changes to do the same for gas lines and water pipes. It's up to you to pinpoint where the savings lie.

■ **Vegetarians and carnivores will dine together on synthetic meats.** We're not talking about tofu. We're talking about nutritious, low-cost substitutes that look and taste just like the real thing. Twitter co-founder Biz Stone has already invested in Beyond Meat, which makes plant-based chicken strips so convincing they almost fooled *New York Times* food writer Mark Bittman.

GOING, GOING . . .

10 things that
will disappear





10 things that will remain the same

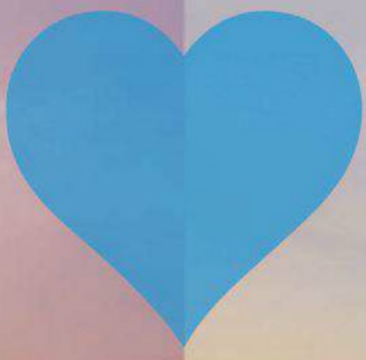
- Beer
- Harmonicas
- Frisbees
- Pocketknives
- Crowbars
- Drill bits
- Charcoal grills
- Pencils
- Dumbbells
- Duct tape

- Eyeglasses
- Video-game consoles

- Postage stamps
- C batteries
- Keys

- Snow tires
- Telephone poles
- Band-Aids

- Wallets
- Flathead screwdrivers



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Wind turbines produced with innovative solutions from BASF can withstand high-speed winds and severe weather conditions. Our products help make the production and installation of wind turbines more efficient, as well as making them durable—from the foundations to the very tips of the blades. In this way, we support the development of wind power as a climate-friendly source of energy. When high winds mean clean energy, it's because at BASF, we create chemistry.

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The Chemical Company

on the horizon

2023-2062

IMAGINE A WORLD WITH HOLOGRAPHIC TV, BIONIC LIMBS, AND WOOLLY MAMMOTHS.



■ **Contact lenses will grant us *Terminator* vision.** When miniaturization reaches its full potential, achieving superhuman eyesight will be as simple as placing a soft lens on your eye. Early prototypes feature wirelessly powered LEDs. But circuits and antennas can also be grafted onto

flexible polymer, enabling zooming, night vision, and visible data fields.

■ **Checkups will be conducted by cellphone.** The technology is no problem. Scientists are hard at work trying to perfect apps that can measure your heart and respiration



WORD UP



All 130 million books on the planet will be digitized.

In 2010 Google planned to complete the job by decade's end, but as of March it still had 110 million tomes to go, so we're adding wiggle room. You might use the time to shop for storage, because given today's options and the average size of an e-book (3 MB), you'll need 124 3-terabyte drives to carry the library of humanity with you. It won't fit into a backpack, but it's small enough to schlep in a hockey bag.



Supersonic jets will return—for good this time.

The limit on supersonic flight is not one of engineering but of economics. Aircraft that break the speed of sound guzzle fuel, so new jet engines will have to be efficient. One solution—the pulse detonation engine, which uses a fuel-air mixture—was tested at the Mojave Air & Space Port in 2008. By 2030 a successor will power that fabled 2-hour hop from New York to London.

rates, perform blood and saliva tests—even evaluate your cough. Question is how long will it take the medical industry to embrace them.

■ **Nurse Jackie will be a robot.** By 2045, when seniors (60-plus) outnumber the planet's youth (15 and under) for the first time in history, hospitals will use robots to solve chronic staffing issues. Expect to find the new Nightingales lifting patients and pushing food carts. Engineers at Purdue University are thinking even bolder—designing mechanical scrub nurses that respond to hand gestures during surgery.

10 SCI-FI TECHNOLOGIES THAT WILL ARRIVE IN THE NEXT 110 YEARS

- The Knight Rider car
- Star Trek's replicator
- Aliens' power loader
- Dr. Leonard McCoy's tricorder
- Luke Skywalker's robotic hand
- Men in Black's neuralizer
- Harry Potter's invisibility cloak
- Marty McFly's hoverboard
- Neuromancer's neural jack
- The Enterprise's holodeck



YOUR HOME WILL

› The refrigerator will place your grocery order. › The carpet will detect intruders and local power consumption and help you make full use of off-peak rates. › The thermostat

GREAT CALL

Within 30 years humans will begin augmenting their brains by plugging the power of tomorrow's cellphones directly into their heads.

— Shawn Carlson, founder of the Society for Amateur Scientists



BUZZ ME

THE SUPER BOWL WILL BE PLAYED ON YOUR LIVING ROOM CARPET

Not the real game, of course, but a 3D hologram of the action projected from your laptop or TV. Current technology allows the images—assembled from the footage of 16 cameras—to refresh every 2 seconds. One day the halfback screen will unfold in real time.



PHOTOGRAPH BY GETTY IMAGES (SUGAR)

■ Highways will handle three times as many cars. According to researchers at Columbia University, vehicles driven by humans use at best 5 percent of a highway's road surface at any given time. If we let technology take the wheel, we could significantly increase the volume of traffic. In one example, Volvo's semiautonomous road train wirelessly connects a stream of cars to a truck driven by a professional. The self-driving cars mimic the speed and steering of the lead vehicle, safely decreasing the gaps while increasing fuel efficiency.

■ Farmers will grow caffeine-free coffee beans. Taking caffeine out of coffee is no easy chemical feat, which is why decaf lacks the rich flavor of the high-test stuff. After years of research, Brazilian scientists have discovered a mutant strain of coffee that's naturally low in caffeine. They won't rest until they learn how to remove every last drop of the sleep-retarding stimulant.

■ Supercomputers will be the size of sugar cubes. The trick is to redesign the computer chip. Instead of the standard side-by-side model in use today, IBM researchers believe they can stack and link tomorrow's chips via droplets of nanoparticle-infused liquid. This would eliminate wires and draw away heat. What it won't do is help you remember where you left your tiny computer before you went to bed.



BE TRULY CONNECTED

summon help if you fall. > Lawn sensors will tell you which part of your yard to fertilize. > The electric meter will monitor will learn your preferences and adjust the climate in each room as soon as you enter.

HEADS UP

We will find life beyond Earth. There's a horse race going on right now, and one of those horses is going to cross the finish line in the next two decades.
— Seth Shostak, senior astronomer, SETI



■ A virtual lawyer will help you plan your estate.

"I don't mean avatars," Cisco's Dave Evans says. "I mean virtual people—self-contained, thinking organisms indistinguishable from humans." Sounds crazy, right? But surely you've seen the magic of CGI. What's to say you can't attach a lifelike visage to an interface fronting the crowdsourced wisdom of the Internet? Give it a nice head of hair, teach it how to smile, and you're looking at a brilliant legal eagle with awesome people skills.

■ Vertical farms will feed cities. There will be 9 billion people on the planet in 2050, seven out of 10 of them in urban areas, and everyone's got to eat. Future food production will depend on farmscrapers that grow pesticide-free crops year-round—making it much simpler to eat local.

■ Connecticut will feed the world. To keep up with all the hungry mouths, we may just have to rethink food. The folks at tech startup Pronutra claim to have discovered an industrious single-cell organism that converts sunlight, CO₂ and water into low-cost nutrients. It works in tight quarters too. Instead of a few thousand pounds of crops per acre a year, we'd be looking at 100,000, according to the company's research. In other words, the planet's protein could be produced in an area half the size of Connecticut.

■ Scientists will discover direct evidence of dark matter. It may account for 23 percent of the mass in the universe, yet we haven't confirmed that dark matter exists. Why? "It's like a hidden magnet," says Dr. Fred Calef of the Mars Science Laboratory. "You can see what it pulls but can't see the source." Theoretical physicist Michio Kaku believes the proof we seek could arrive within 15 years, helping us to unlock the origins of our universe, and maybe even open the door to another one.

■ Navy SEALs will be able to hold their breath for 4 hours. Advances in nanotechnology will help us overcome not only illness but also the limits of being human. For example, robotic red blood cells called respirocytes could each hold 200 times the oxygen of their natural counterparts, enabling a man on a mission to, say, hide out underwater for half a day without a scuba tank.

THE PM
BRAIN
TRUST
SAYS:

WITHIN 20 YEARS

The first fully functional brain-controlled bionic limb will arrive.

WITHIN 30 YEARS

Soldiers will use exoskeletons to enhance battlefield performance.

WITHIN 40 YEARS

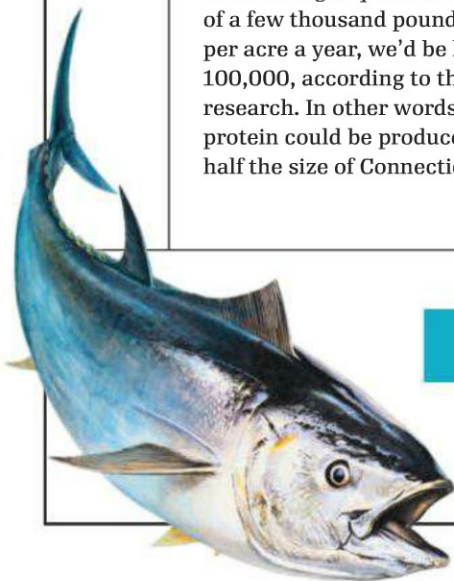
Nanobots will perform medical procedures inside our bodies.

WITHIN 50 YEARS

Doctors will successfully transplant a lab-grown human heart.

WITHIN 60 YEARS

Digital data (texts, songs, etc.) will be zapped directly into our brains.



Tuna will be raised on farms.

Ah, the bluefin—powerful, dangerous, graceful . . . and delicious served raw. Long reproduction cycles and a migratory lifestyle make it hard to tame, though. Pioneering fish farms in Mexico are now raising the species, fattening tons of fish in massive underwater pens. Similar efforts are underway in the U.S., Japan, and the Mediterranean.

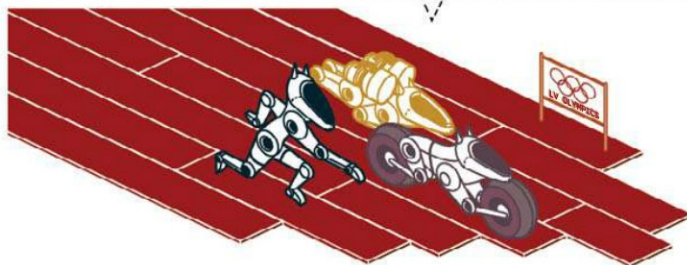
the great beyond

2063-2122

THINK HYPERSONIC MISSILES, ION ENGINES,
AND FARM-FRESH HOMES.



■ **Robots will rule the LV games!** China started hosting the International Humanoid Robot Olympic Games in 2010, and inventor Dean Kamen is pushing for high-tech competitors in Rio de Janeiro in the summer of 2016. "The original Olympic skill sets were javelin throws, wrestling, and fighting skills that countries needed for defense," he says. "In the



21st century, sports should require modern skills like programming and mechanical prowess." We say let's get started. By 2100 we hope to design the android version of Michael Phelps.

■ **The Pentagon will say goodbye to large submarines.** With the steady improvement in sonar technology, our subs are already hard-pressed to evade detection. In the future, underwater robots with laser radar or other nonacoustic sensors will make the seas virtually transparent. So how will we deploy our nukes? Hypersonic missiles launched from our own shores will reach any target in the world within 1 hour.

IN THE LONG
RUN

We're all gonna die.
— *MythBusters* host Jamie Hyneman



**THE PM
BRAIN
TRUST
SAYS:**

WITHIN 50 YEARS We will fly the friendly skies without pilots onboard. And renewable energy sources will surpass fossil fuels in electricity generation.

WITHIN 60 YEARS We will activate the first fusion power plant. And we will wage the first battle in space.

WITHIN 100 YEARS The last gasoline-powered car will come off the assembly line.



People will grow their own homes.

The sustainable house of the future will be constructed from living, breathing trees coaxed into intricate patterns. Unlike this dollhouse, the Fab Tree Hab takes at least five years to rise to a full-size abode. After starting out on a farm, it can be transplanted to the address of your choice. You might need a few decades, though, to make it *MTV Cribs*-worthy.



AN ION ENGINE WILL REACH THE STARS

If you're thinking of making the trip to Alpha Centauri, pack plenty of snacks. At 25.8 trillion miles, the voyage requires more than four years of travel at light speed, and you won't be going nearly that fast. To complete the journey, you'll have to rely on a scaled-up version of the engine on the Deep Space 1 probe, launched in 1998. Instead of liquid or solid fuel, the craft was propelled by ions of xenon gas accelerated by an electric field.

- › Doctors will check your vital signs around the clock via tiny sensors.
- › Stomach chips will monitor your diet to help you lose weight.
- › Spinal cord implants will reverse paralysis.
- › Brain chips will let you absorb data while you sleep.
- › Brain interfaces will help you fully inhabit virtual worlds.

■ Scientists will map the quadrillion connections between the brain's neurons. Quadrillion sounds like a made-up number, but we assure you it's real. Those connections hold the answers to questions about mental illness, learning, and the whole nature versus nurture issue. If every one of them were a penny, you could stack them and

build a tower 963 million miles high. It would stretch past Mars, Jupiter, and Saturn and stop roughly halfway to Uranus.

■ One of us will celebrate a 150th birthday. Our money's on Keith Richards. Given recent advances in health, technology, and medicine and the rise of genome science, it's only a matter of time until someone gets to blow out all those candles—especially if you toss in a breakthrough on the scale of antibiotics, says David Ewing Duncan, author of *When I'm 164*. What are your odds of living to see our predictions come true? There are more than 300,000 centenarians on the globe already—and one hearty soul has reached the age of 122. **PopMech**



It's about dreams.

Are you living your dream?



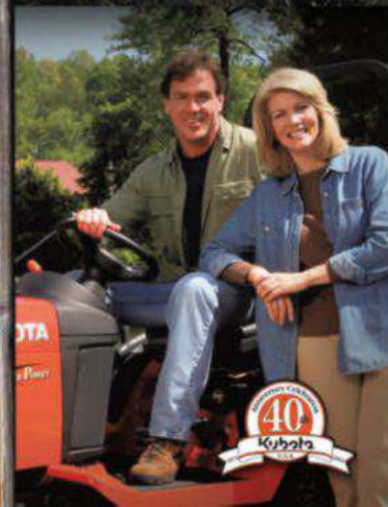
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The guide to your diy life 

DIY HOME

Today's home tech and how it's shaping the house of tomorrow.
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DIY SCIENCE

Search for aliens with your computer. Find E.T. with SETILive.
p. 112

DIY TECH

How to ensure your data survives the next century and beyond.
p. 114



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**EARLY ADOPTER**

Build our sturdy knock hockey table, and keep this classic game in the family for years to come.

PopularMechanics

W

weekend



HOME SCIENCE TECH AUTO ADVENTURE

4

DIY AUTO

HANG ON
TO THAT
PLYMOUTH
NEON!

10 UNEXPECTED CLASSIC
CARS OF THE FUTURE.

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Home

- FIXING HOLIDAY LIGHTS
- CORDLESS JIGSAWS
- ROOF VENTING



BY ROY
BERENDSOHN

diy



*The World
of Tomorrow*

THE HOUSE OF THE FUTURE

HOW LEADING-EDGE TECHNOLOGY TODAY WILL HELP BUILD A BETTER HOME TOMORROW. BY DAVID AGRELL

B

uying a home means investing in the future. But the house you're in today won't be entirely compatible with your needs tomorrow. Rising costs—and, in some cases, dwindling availability—of energy and water are changing how our dwellings function. Meanwhile, social trends dictate not only how we build homes, but also how we live in them. The industry is responding by developing construction methods and materials that outperform anything used in the past, while automated systems help homeowners do more with less. That may sound like we're on the road to domestic austerity, but, well, we're not. "We don't have to choose between being responsible and keeping our quality of life," homebuilder Ron Jones, of Placitas, N.M., says. "We can have both." Here, PopMech explores emergent systems and anticipates how they'll shape the house of tomorrow. Are you ready?



Virginia Tech's award-winning 2011 Solar Decathlon entry, the Lumenhaus, points the way forward. Made largely of recycled materials, it includes solar power, an open plan, convertible countertops, movable interior and exterior panels, and other smart details.

W

WEEKEND

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DIY HOME / BUILDING A BETTER FUTURE

Home Automation

SMART HOMES MONITOR THEIR OWN EFFICIENCY—AND ALSO MAKE LIFE EASIER AND SAFER.

Today

In smart homes a single device—often a smart-phone—controls lights, appliances, heating, irrigation, and even door locks to better suit the home's function at a given time. Smart thermostats, such as the Nest, study how you live and make adjustments to fit. The more sophisticated the automation, the more efficient and comfortable a home can be.

Tomorrow

The home will be equipped with a central nervous system that will sense and analyze all appliances and systems, making adjustments when needed. It will send us messages to tell us we're out of milk and even order it for us. Biometrics will replace the key: We'll unlock doors via a handle that validates our thumbprint before activating the circuit.



Automation made easy: The Nest anticipates your needs and adjusts accordingly.



Lightweight concrete like this will be poured to create entire prefab homes.

Construction

CHEAPER, FASTER, AND MORE DURABLE PREFAB SYSTEMS WILL REPLACE LUMBER FRAMING.

Today

Some stick-framed homes aren't durable enough to survive the life of their mortgage. That's partly due to cost-cutting construction methods that undermine quality. But whenever many parts, each with inherent flaws, combine to create a single structure, problems arise. One solution is to prefabricate whole exterior walls in a factory. Prefab homes aren't a new idea, though they're often associated with cheap, flimsy, or temporary structures. But high-quality modular systems that feature concrete-based panels, wood composites, or

structural insulated panels are changing that perception. Insulated wall units arrive on-site with window cutouts and electrical and plumbing conduits in place. "This is cost-effective and reduces building-site errors," says New Mexico builder Ron Jones, a National Association of Home Builders consultant.



MARIANNE CUSATO
Urban designer
and author

"Young people are very interested in modular homes. They can see past the image of the double-wide trailer. We're not building trailers but something 10 times better than a site-built house."

Tomorrow

Massive parts, including entire walls and roofs, will be poured from autoclaved aerated concrete, a porous, lightweight product with great strength and excellent insulating properties. These sections will be lifted into place on-site by cranes. The home's window assembly will be prefabricated too. The receiver jamb will arrive preinstalled in a wall, and a sash assembly will be added using a weatherproof lever-lock mechanism. To change window styles or replace a damaged window, homeowners will simply unlock the levers on the interior jamb and put in new panes.

W

WEEKEND

Social Trends

PERCENTAGES OF ECHO BOOMERS WHO CONSIDER THESE FEATURES "VERY IMPORTANT" (SOURCE: THE CONCORD GROUP)



Today

Echo boomers—the children of baby boomers—don't want sprawling, suburban homes. Data collected by real estate consultants RCLCO show that two-thirds would

rather live in a diverse, walkable community, while half would trade a large lot for closer proximity to work and shopping. "We're changing this idea of location, location, location," says urban designer Marianne Cusato.

Tomorrow

Echo boomers will become not only the largest group of homeowners since their parents but homebuilders too. That shift could spell the end for stick-framed houses. "Echo

boomers are going to be more open to the efficiencies of modular building," Cusato says. They will also be far more likely to use plumbing and heating systems that help save water and energy.



IT'S JUST INTEGRATED DUAL EXHAUST.



SO WHY ARE WE THE ONLY
ONES TO OFFER IT?

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NEW RULES

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Energy

SOLAR ENERGY NOW TURNS ROOFS INTO POWER GENERATORS, BUT FUTURE HOMES WILL GO ONE BETTER, USING LESS ENERGY OVERALL.

Today

Our homes consume a quarter of the nation's energy, and heating and cooling alone can guzzle up to 60 percent of a typical household's \$2200 annual energy bill. But modern temperature-control systems use a fraction of the energy they did a generation ago, and the appliances are downsizing. Some furnaces today are no bigger than a three-drawer cabinet. The number of homes with ultralow energy demands is also increasing, thanks to tight door seals, high-R insulation, and low-U windows, which can help reduce bills by up to 90 percent. (High-R and low-U factors indicate better insulation and greater resistance to heat conductivity, respectively.) Still, a third of the home's energy is used to heat water. The roof can provide the solution: It's a gigantic heat sink, absorbing solar energy from above and heat from rooms below. This energy can be used to heat water *and* rooms.

A roof can also generate electricity via photovoltaic peel-and-stick film applied directly to a metal roof or with roofing shingles that contain solar arrays.

Tomorrow

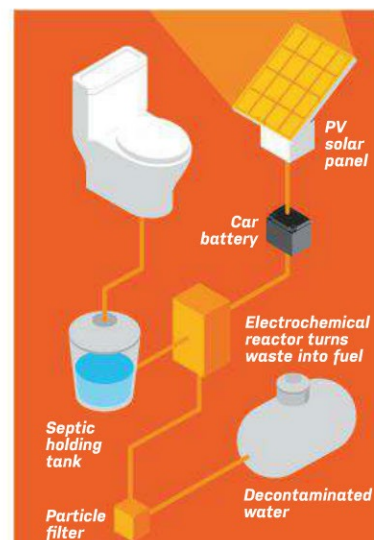
Sophisticated heating and cooling systems will monitor current weather forecasts to keep conditions comfortable. Heat-transport fluids developed by the University of Maryland contain heat-absorbing nano-size particles that move through tubing under the roof deck, transporting waste heat to a heat exchanger. Improved photovoltaic roof panels will become efficient enough to power separate circuits that feed LED lights, computers, and other electronics. Windows will help out as well. UCLA researchers have developed a transparent PV film that is applied directly to glass.



DONALD PRATHER
Air Conditioning
Contractors of
America

"Today's heating and cooling equipment is already more advanced than what was used in the space shuttle. In a hundred years we'll need four-year degrees to service equipment used in the home."

Peel-and-stick photovoltaic solar panels can replace traditional systems that are high-maintenance, bulky, and expensive.



Future homes will borrow technology from Caltech's award-winning toilet.

Water

RIISING RATES AND DWINDLING RESOURCES WILL ENCOURAGE US TO USE LESS.

Today

Water rates soar as municipalities grapple with economics, infrastructure upgrades, and droughts. But water usage—and bills—are slashed in half by installing low-flow showerheads and faucet aerators, fixing leaky pipes, and retrofitting toilets with low- or dual-flush devices. Outside, moisture meters and soaker hoses manage irrigation better. Rain collectors and drought-resistant plants complete the equation.

Tomorrow

Local governments will relax restrictions on graywater systems that recycle non-sewage waste for nonpotable uses. The rising cost of municipality-supplied water will lead to sophisticated monitoring devices that track each and every drop—to the dollar. Suddenly, Caltech's vision of a better toilet—a solar-powered unit that recycles water and turns waste into fuel (above)—doesn't seem so far-fetched.

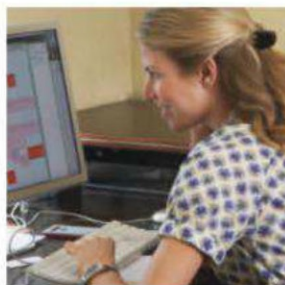
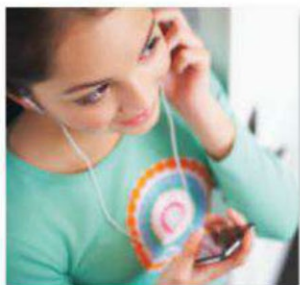
17.9%

AVERAGE INCREASE IN WATER RATES ACROSS 30 MAJOR U.S. CITIES SINCE 2010
(SOURCE: CIRCLEOFBLUE.ORG)

W

WEEKEND

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Reliable power backup for 24/7 availability

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ES Series

The ever-popular ES models are priced affordably yet provide enough extended runtime to allow you to work through short and medium power outages. Some power-saving models have been designed to actively reduce energy costs.

The energy-efficient ES 750G

The ES 750G boasts innovative power-saving outlets, which automatically shut off power to unused devices when your electronics are turned off or asleep, eliminating wasteful electricity drains.

- 10 outlets
- 450 watts / 750 VA
- 70 minutes maximum runtime
- Telephone/network protection



The best-value ES 550G

The ES 550 uses an ultra-efficient design that consumes less power during normal operation than any other battery backup in its class, saving you money on your electricity bill.

- 8 outlets
- 330 Watts / 550 VA
- 43 minutes maximum runtime
- Telephone/network protection



APC
by Schneider Electric



Ice? Not for this hockey. Isabel Pedroza, 10, stands tall against Ada Larsen, 8, while Emilio Muscarolas, 9, trades shots with his brother Diego, 11.



WEEKEND

KNOCK HOCKEY TABLE

Early Adopter

THE STURDY CONSTRUCTION OF THIS KNOCK HOCKEY TABLE MAKES IT AN HEIRLOOM-IN-WAITING.

Introduced as Nok Hockey in 1942 by the Michigan-based Carrom Company (pun alert!), this classic game requires driving a puck on the correct angle with the right amount of force—just like ice hockey. Though the players wear no padding, the competition is as fierce as it is addictive. The playing surface of a store-bought knock hockey game is usually made of particle-board. We chose birch plywood for durability.

DEGREE OF
DIFFICULTY
5/10

AGES: 8+

BUILD TIME:
2 HOURS

PARTS COST:
\$40





Prep the base, cut out the goals, and attach one short rail

1. Use fine (120-grit) sandpaper to smooth out any sharp edges or corners on the base. Prime the top, bottom, and sides with latex paint and let dry. Add two light coats of colored gloss paint to one side of the base and let dry. We chose a bright blue spray paint. You may opt for a brush or roller; just be sure that the finishing coat is uniform so that the playing surface is slick.
2. On the center of the face of each short rail, make marks $\frac{1}{2}$ inch from the bottom and 1 inch from the top. Place additional marks $2\frac{1}{2}$ inches on either side of the bottom-center spot. Draw a line connecting the three marks along the bottom of each short rail, and then freehand an arc connecting the ends of that line with the top-center mark. These are the goal outlines. Drill $\frac{3}{8}$ -inch pilot holes at the end of each line, then cut out the goals.
3. Apply beads of wood glue along the bottom of the inside face of one short rail and along one short edge of the base. Center and press the rail against the base. Drill two $\frac{1}{16}$ -inch pilot holes about 2 inches from the outer edges of the goal, $\frac{1}{4}$ inch from the bottom of the rail. Drive $1\frac{1}{2}$ -inch 4d galvanized nails into the pilot holes.

Attach the long rails, second short rail, and corner bumpers

1. Apply beads of glue to the bottom and one end of one long rail, and to the edge of the short rail protruding to the side of the base. Press the long rail against the base and the short rail. Drill four pilot holes through the rail into the base. Add three more pilot holes vertically along the edge of the short rail into the end of the long rail. Nail the long rail into place. Repeat on the other side.
2. Attach the second short rail, using the same method as above. Glue the corner bumpers into the corners.

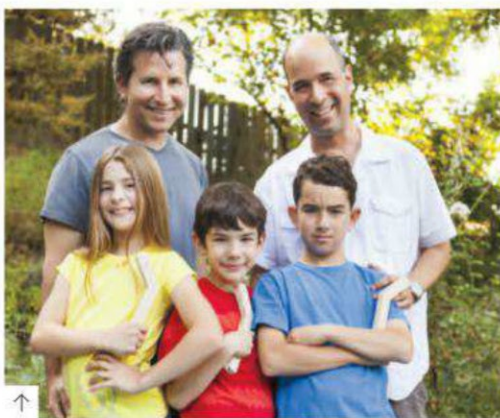
Affix the goal blocks, and paint the blue lines

1. Mark a spot 9 inches from each short rail, on center with the goal. Apply glue to the bottom of each goal block, and place one corner flush with each spot. Drill two $\frac{3}{8}$ -inch pilot holes through each block into the base, and drive a $\frac{3}{4}$ -inch No. 8 screw into each hole.
2. Make two marks 18 inches from each short rail, and mask off a $\frac{1}{2}$ -inch space to the side of each mark. Paint, let dry, remove tape.



Parts/cut list

- ▶ One 2 x 4-foot piece of smooth $\frac{1}{2}$ -inch plywood (base); the project shown here uses birch, but you may choose to use maple or even pine, provided the surface is level and uniform
- ▶ 2 pieces of 1 x 4 pine, 48 inches long (long rails)
- ▶ 2 pieces of 1 x 4 pine, 25 $\frac{1}{2}$ inches long (short rails; the arched goals will be cut out of these rails)
- ▶ Two 3 $\frac{1}{2}$ -inch squares of 1 x 4 pine; these are cut in half diagonally to form the corner bumpers
- ▶ Two 1 $\frac{1}{2}$ -inch squares cut from 1 x 4 pine (goal blocks)
- ▶ One 2 $\frac{1}{2}$ -inch-diameter circular piece cut from 1 x 4 pine (puck)
- ▶ Two 12-inch-long pieces of 1 x 4 pine cut to desired shape and size for hockey sticks



Adult supervision is advised (and welcome here, as the smiles show) because power tools are involved. Back row from left: Octavio Pedroza, Isabel's dad, and Richard Leow, Emilio and Diego's dad.

Diego measures and marks the location of a playing-surface dividing line.



Tool Test

JIGSAWS

O

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BOSCH
JSH180-01

RANKING ★★★★★

Price: \$328
(kit with two batteries)

Voltage: 18

Battery: Li-ion,
2.6 amp-hours

Chuck: One-hand
insert, two-hand
release

Weight: 5.4 lb

**3/4-in. plywood;
linear feet
ripped:** 75

Likes: The
second-lightest
tool in our test
is compact and
smooth-cutting.

Dislikes: Bevel
adjustment
requires an Allen
wrench; a \$328
saw should cut
more on a single
charge.



CRAFTSMAN
11569

RANKING ★★★★★

Price: \$60
(tool only)

Voltage: 19.2

Battery: Li-ion,
1.5 amp-hours

Chuck: Two-
hand insert, two-
hand release

Weight: 5.9 lb

**3/4-in. plywood;
linear feet
ripped:** 40

Likes: Onboard
storage makes
spare blades
readily available.

Dislikes: Granted, it's
inexpensive, but
it lost the cut-
ting contest by
a long shot.



DEWALT
DCS331

RANKING ★★★★★

Price: \$280
(kit with one
battery)

Voltage: 20

Battery: Li-ion,
3 amp-hours

Chuck: Two-
hand insert, one-
hand release

Weight: 6.8 lb

**3/4-in. plywood;
linear feet
ripped:** 107

Likes: This saw
combines speed
and power with
endurance. Its
cutting action
is smooth, even
in a tight radius.
And it has
tool-free bevel
adjustment.

Dislikes: None.



HITACHI
CJ18DSL

RANKING ★★★★★

Price: \$129
(tool only)

Voltage: 18

Battery: Li-ion,
3 amp-hours

Chuck: Two-
hand insert, two-
hand release

Weight: 5.2 lb

**3/4-in. plywood;
linear feet
ripped:** 100.5

Likes: Steamed
past the stal-
wart Bosch and
the Craftsman
in the plywood
test; also cut
a respectably
smooth 4 3/4-in.-
radius curve.

Dislikes: Pesky
Allen-key bevel
shift.



MAKITA
BJV180

RANKING ★★★★★

Price: \$440
(kit with two
batteries)

Voltage: 18

Battery: Li-ion,
3 amp-hours

Chuck: Two-
hand insert, two-
hand release

Weight: 6.4 lb

**3/4-in. plywood;
linear feet
ripped:** 82

Likes: It's
compact and
solid and cuts
consistently
square thanks
to a stout chuck
propelled by
a 3/16-in.-thick
driveshaft.

Dislikes: The
Allen-adjusted
bevel—again!



MILWAUKEE
2645-20

RANKING ★★★★★

Price: \$130
(tool only)

Voltage: 18

Battery: Li-ion,
3 amp-hours

Chuck: Two-
hand insert, one-
hand release

Weight: 7.8 lb

**3/4-in. plywood;
linear feet
ripped:** 101

Likes: The race
was too close
to call between
this saw and
the DeWalt. It
churns through
cuts like a loco-
motive hurtling
down the track,
aided in part by
its extra weight.

Dislikes: None.

TIE:
Best
OverallTIE:
Best
Overall

WEEKEND

JIGSAWS PRO MODELS VERSUS THOSE FOR OCCASIONAL USERS

Not everyone needs a pro-quality power tool. If you rarely use a jigsaw, there are plenty of inexpensive models to choose from. You'll find our review of four budget-priced saws at popularmechanics.com/jigsaw.

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Stephen Dorff

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Photography by Francesco Carrozzini



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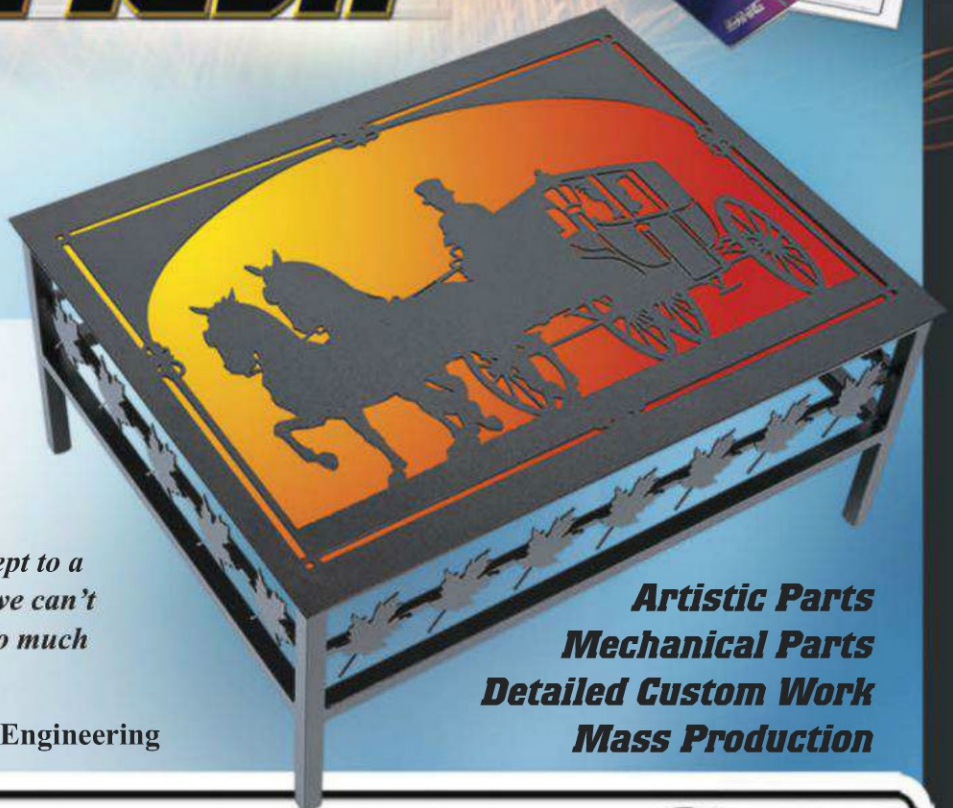


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-Jim, Custom Turbo Engineering



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Home Clinic

BY
DAVID AGRELL
PHOTOGRAPH BY PHILIP FRIEDMAN

How to Fix a String of Mini Lights

Every year I experience the same disappointment around the holidays: When I unpack the previous year's mini lights, they almost always don't work. Even replacing a bad bulb or two doesn't seem to remedy the problem. Are these lights worth saving, or should I just give up and buy new ones?

You're not alone on this one. At some terrible moment in early- to mid-December, we can almost hear the collective sigh of dismay as good people around this land untangle and plug in strings of bad mini lights. Above the din we also hear a few expletives, because the mass-produced sets can be pricey. Your impulse to fix them is noble, but the

task should not be undertaken lightly (sorry, unavoidable pun), because the strands contain scores, if not hundreds, of tiny incandescent bulbs. Which one is the culprit? Or are there several burnouts?

Regardless, don't give up. With a few handy tools and a modicum of holiday spirit, mini lights can be repaired.

First step: diagnosis. You need to figure out if it's actually a bad bulb causing the malfunction or something else. Keep in mind that smaller sets are wired in series—that is, the electrical current must pass through each individual bulb in order to complete the circuit and illuminate the set. Larger strings often feature two or more series circuits wired in parallel, which explains why sometimes just a section of the strand won't light up. Often, simply replacing a bad bulb will fix the entire set or at least a section of it.

But locating the faulty bulb can be tricky. You'll need either a set of basic electrician's tools or the LightKeeper Pro (\$19.95; lightkeeperpro.com), a dedicated tool that combines a voltage detector, a bulb remover, bulb and fuse testers, and a shunt repairer. More on that later.

If you're lucky, simply plugging in the mini lights will reveal a bad bulb.

The LightKeeper Pro may look like a gun but instead is a powerful tool for diagnosing and fixing faulty lights.

GLOSSARY

SHUNT

Aluminum wire wrapped around the copper posts at the base of a mini light bulb. If the bulb's filament breaks, the electrical current burns off the shunt's oxide coating and turns it into a conductor. This lets the current bypass the bad filament to complete the circuit.

W

WEEKEND

1

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— BRING TO THE JOB. —
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"Bad" may just mean it needs to be seated more firmly in its socket. In any case, you can remove and test a bulb using the LightKeeper Pro or a multimeter. If you install a new one, make sure it has the proper voltage rating or you risk damaging the whole set.

Fixing a string of lights isn't always that simple. All or part of it may be dark because of a broken filament or a sketchy shunt (see glossary). If a bulb's filament breaks, the shunt is supposed to redirect current through the base of the bulb, maintaining the electrical circuit. You can fix a faulty shunt with the LightKeeper Pro. Simply plug in the strand, remove a bulb that's in or near the darkened section, and insert the tool into the bulb's socket. Pulling the trigger activates a piezo circuit, which sends a high-energy pulse through the set. After about 20 pulses, any faulty shunt should be activated.

If you're still having trouble locating where the circuit is broken, try using a voltage detector. There's one built into the LightKeeper Pro, or you can use an electrician's model. Still nothing? Check the fuse located behind a small sliding panel on the male end of the plug. If it's fried (you can check it with the LightKeeper Pro), be sure to replace it with a new one of the correct rating, which should be indicated on the plug. And if all else fails, buying a new string may be irksome, but at least it'll keep some small part of your holidays bright.

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GOT A HOME-MAINTENANCE OR REPAIR PROBLEM? ASK THE EDITORS.

Send your questions to pmhomeclinic@hearst.com or to Home Clinic, Popular Mechanics, 300 W. 57th St., New York, NY 10019-5899. While we cannot answer questions individually, problems of general interest will be discussed in the column.



Dealing With Popped Nails

Our home is less than 10 years old, but there are a number of places outside where nails are sticking out of the wood instead of the heads being flush. Some of these are on our deck handrails, balusters, and trim. I just drive the nails down, but a few months later they pop up again. How can I fix this problem?

It's annoying, right? Here's what happens: The wood expands and contracts when humidity increases and decreases, respectively. The expanding wood pushes up on the nailhead, but when the wood shrinks, it simply slides down the nail's shank. This process gradually jacks up nails above the surface.

As you've found, driving the nail down is only a temporary fix—it's like playing Whac-A-Mole but less fun. So here's what you do. Pull out one of the nails and buy a box of fasteners that are the same size or slightly larger; we recommend hot-dipped galvanized nails that have either a ring shank or a screw shank. The ring-shank or screw-shaped depressions increase the surface area and gripping power of these fasteners. Remove the remaining jacked nails and replace them with the new nails, or drive stainless-steel or hot-dipped galvanized wood screws in the holes. Either way, take care not to split the wood. You can avoid this by increasing the hole's depth or diameter with a drill bit. If you're concerned about maximum fastening power, leave the nail where it is, bore a fresh pilot hole adjacent to it, and drive a screw there.

Time to Vent

The previous owner of my house remodeled the living room by removing the ceiling joists, installing collar ties, and building a cathedral ceiling. The problem, apparently, is that he covered the eaves' soffit vents with perforated vinyl siding and insulated between the 2 x 6 roof rafters without using baffles under the roof deck. Also, there isn't a ridge vent. Should I be worried about damage to the roof?

The short answer is, yes, you should be worried. Attics are ventilated to prevent condensation on the underside of the roof deck—heading off damage to rafters, sheathing, and insulation. In areas of heavy snowfall, ventilation helps stop the formation of those pesky ice dams that collect water and cause it to leak into the roof. In the summer, ventilation keeps the roof deck cool, which some say can prolong the life of asphalt shingles. In any case, fresh air should be entering the attic through the soffit vents before moving unhindered between the rafters and out of the ridge vent, taking warm, moist air with it.

With your house, the insulation packed between the rafters is blocking fresh air from moving from the soffits to the ridge. I hate to tell you this, but it looks like you need to remove the drywall from the ceiling, take down the insulation, inspect the roof deck for condensation damage (replacing any damaged roof deck and roofing), install insulation baffles and new insulation, and then drywall. Finally, to complete the work properly, you'll need to cut in a ridge vent. This will allow the proper movement of ventilation air from the soffits to the ridge.

I realize this all sounds a bit drastic, but it will help prevent serious damage to the roof as well as the growth of mold in the roof cavity and on the back of the dry-wall ceiling surface.

By way of background, the International Residential Code calls for a total venting area (including that of the ridge vent) of $\frac{1}{150}$ the size of the room's floor space, though certain conditions, such as the presence of vapor barriers, may reduce that number. There are several ways you can meet this requirement, so check your town's building codes to find out what is needed where you live.

When you go to replace the insulation, position the vapor barrier facedown toward the living space. Be sure not to block the soffit vents; this can be avoided by installing baffles where the roof meets the exterior wall. Another option worth considering is to have a contractor install air-impermeable insulation, such as closed-cell spray foam, directly to the underside of the roof deck. With this method, you might not need to add a ridge vent. **PopMech**



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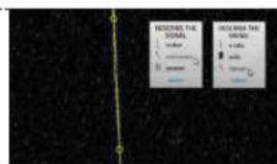
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diy

Science



BY MADELINE BODIN

ANSWERING
E.T.'S CALLTAPPING INTO SETI'S 42-DISH
TELESCOPE ARRAY TO SEARCH
FOR ALIENS.

SETILive volunteers categorize the signals they see online. The angle of the image is important; it can help indicate whether a transmission comes from an object in orbit or from deep space.



This is the erratic signal from a wobbly satellite. The SETI Institute needs human observers to help screen out near-Earth signals such as this.



A "broken" or pulsed pattern normally indicates ground-based radio interference.

T

hrough a radio telescope, a signal from an alien civilization would probably look a lot like a signal from a satellite orbiting Earth, only fainter. At least that's what scientists engaged in the search for extraterrestrial intelligence (SETI) suspect.

After a brief shutdown for budgetary reasons, the SETI Institute is using California's 42-dish Allen Telescope Array to investigate the 2321 exoplanets turned up by NASA's Kepler space-based observatory, which is searching for Earth-like planets.

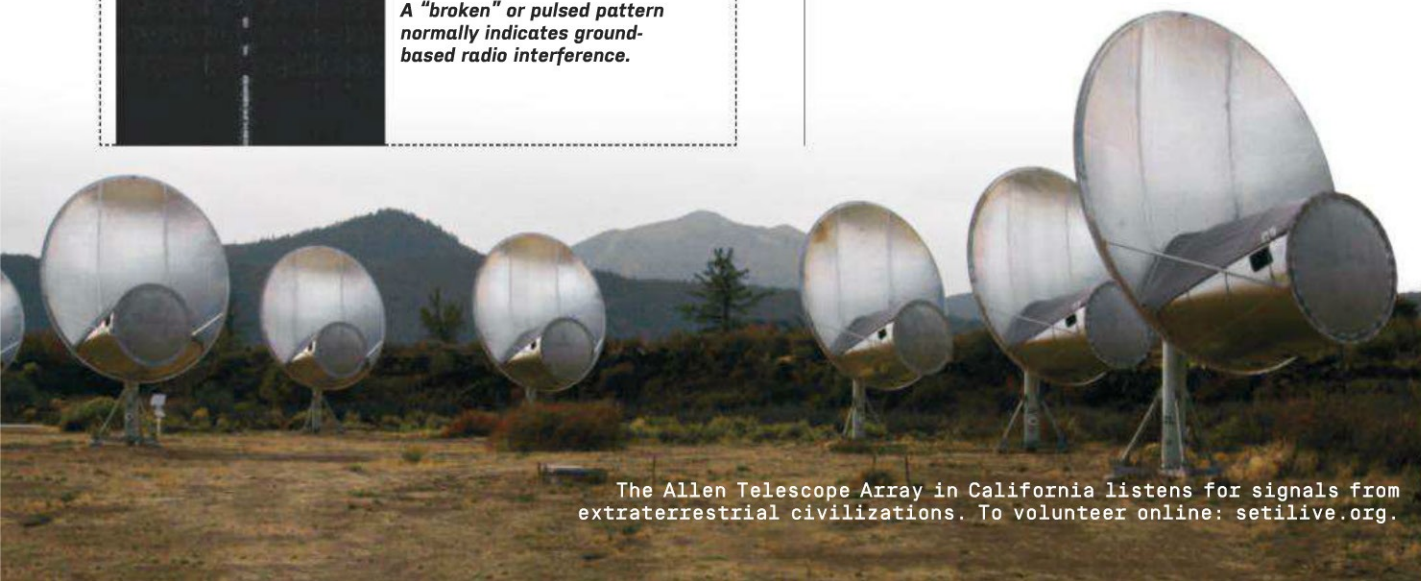
Jill Tarter, the Bernard M. Oliver chair at the SETI Institute—and the model for Jodie Foster's character in *Contact*—says the most promising window for signals is from 1 GHz to 10 GHz. Unfortunately, that range is noisy with everything from GPS satellite signals to Wi-Fi communications. And computer algorithms can only do so much.

Since February 2012, SETILive has been receiving help from volunteers who review the data online, categorizing white lines that appear against a background of radio static that looks eerily like a starry sky. Depending on which frequencies the array is searching, as many as half the views or as few as one in 10 will show some kind of line. After watching for several hours, I saw live signals only once, but you can also examine archived data. Assessments that a signal might be E.T. send the telescope back for a second (and even a third) look at about 10 percent of the signals.

SETILive is the fruition of Tarter's 2009 TED Prize wish: "to empower earthlings everywhere to become active participants in the ultimate search for cosmic company." If that sounds like a message destined to attract people wearing tinfoil hats, Tarter is unconcerned. Even if all that's found are GPS satellite signals, she believes the search itself has value. It "holds up a mirror to humanity," she says. "We are all earthlings. That perspective may help trivialize the differences that we all struggle with today." **PopMech**

W

WEEKEND



The Allen Telescope Array in California listens for signals from extraterrestrial civilizations. To volunteer online: setilive.org.



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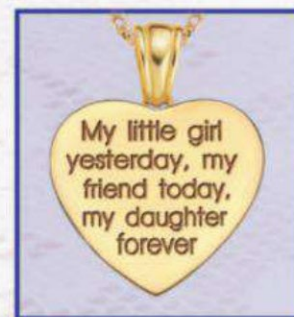
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Tech

- TRADING UP YOUR GADGETS
- WINDOWS ON A MAC
- SAFETY ON PUBLIC WI-FI



BY RACHEL
Z. ARNDT

S

ix months away from completing his sociology dissertation in 1992, Robert Runté realized his floppies were readable only by an Osborne computer—and he was the only person he knew who still used one (released in 1981, the 25-pound Osborne is considered to be the first “portable” computer). So he uploaded his file to the University of Alberta’s mainframe—what could be more secure than that, he thought. Sure enough, about a year and a half later his ancient computer died, but because he had a backup, he didn’t mind when the people at the repair

place “all laughed uproariously at the thought of trying to find parts” for the Osborne in order to fix it. He was covered.

Except that years later when he went to retrieve the data, Runté found the university mainframe he had backed up to had been torn down and replaced by Mac servers. (Luckily, Runté had his dissertation

FUTURE-PROOFING YOUR DATA

LEARN THE HABITS THAT WILL MAKE YOUR DATA LAST FOR THE LONG HAUL. BY MELANIE PINOLA



The World
of Tomorrow



10

WEEKEND

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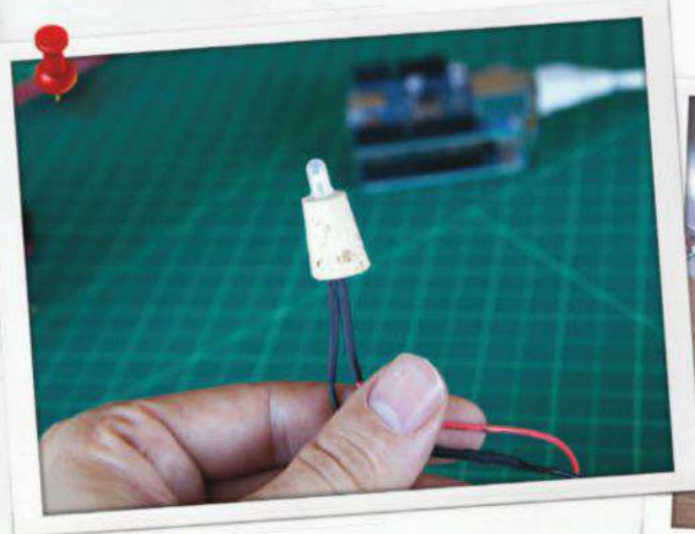


A CELEBRATION OF AMAZING CREATIONS
AND THE PARTS THAT MADE THEM POSSIBLE

THE EMAIL ORB

This mysterious-looking device tells you when you've got mail!

● ● ● **DIFFICULTY LEVEL:
ADVANCED**



This is the time of year when we all want to hear from our family and friends, so here's a cool device you can build that flashes whenever new emails arrive. It's a fun, creative project that combines simple electronics with a bit of craftiness to make something truly unique. It's also a great way to learn how to make your electronic project communicate over the Internet.

At the heart of the "Email Orb" is an Arduino—a programmable device that can be used to make all sorts of interactive projects. Another important piece is the Arduino Ethernet Shield. Shields are Arduino add-ons that can do things like control motors, play sounds or provide a slot for an SD card for storing data. With an Ethernet Shield, your Arduino can connect and exchange information online.

We've hidden the Arduino and all the electronics inside of some items we found at a thrift store. The

Arduino is installed inside of a candy tin, and the LED is mounted inside of the glass bulb from an old coffee percolator. When assembled, our device has a cool retro look!

HERE'S HOW IT WORKS:

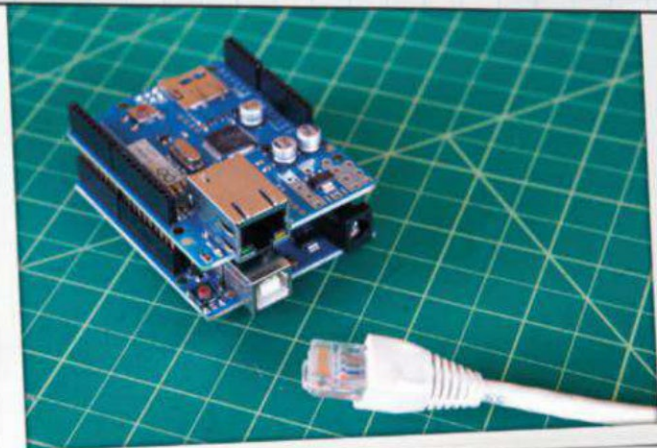
The Ethernet Shield plugs right into the Arduino. There is a port on the shield for an ethernet cable, so you can connect to your network hardware (your cable or DSL modem, or an ethernet switch). The electronics are really simple and consist primarily of a big red LED.

The smarts of this device are in the Arduino program (called a sketch). With just a few lines of code, we can tell our Arduino to connect to a remote server to find out how many emails are waiting for us, and pulse the LED accordingly—once for each email.

Detailed instructions for building this project can be found at RadioShackDIY.com.

PARTS

- ☐ Arduino Uno
- ☐ Arduino Ethernet Shield
- ☐ 10mm red LED
- ☐ 150-ohm resistors
- ☐ SPST toggle switch
- ☐ 9V battery
- ☐ 9V snap connector
- ☐ Size M coaxial
- ☐ DC power plug
- ☐ Hookup wire, stranded

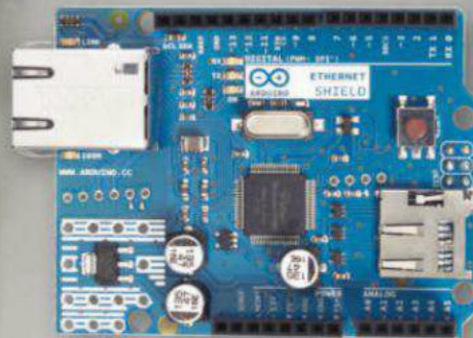


This is just one of many possibilities. For example, imagine a “smart” holiday ornament that checks the weather online and glows to let you know when it’s going to snow!

By Ken Murphy



THE EMAIL ORB FEATURES
THESE  RadioShack PARTS:



Arduino Ethernet Shield



150-ohm
Resistors



Stranded Hookup Wire



SPST Toggle
Switch



Size M Coaxial
DC Power Plug



Energizer 9V
Battery

To see “how-to” project videos and explore more great creations, visit RadioShackDIY.com.



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TO LEARN MORE





printed out.) Today Runté, a professor at the University of Lethbridge in Alberta, backs up to multiple devices and advises grad students to send a hard copy of every new chapter of their all-important theses to the most reliable of off-site backups: Mom.

Runté's experience points to the ultimate, inevitable problem with data storage: All interfaces and formats eventually die. Data storage consultant Tom Coughlin, founder of Coughlin Associates, calls it a fight against nature, saying, "the laws of thermodynamics are against you."

Such a battle makes for a hazy long-term outlook. Will your data be accessible in 100 or even 50 years? Perhaps, but those data will likely be in different formats and will certainly be stored on different media than they are today. All modern-day technologies grow obsolete; either the hardware breaks or is replaced by something better, or new software takes over for the old, or both. In 50 years you may have a computer that can read PDFs, but you might have those PDFs stored on a medium the computer can't read. Or

the opposite may happen, with data stored on a readable format but saved in long-gone file formats. The key to preventing either case is accepting the nonstop job of staying technologically up to date.

Because there's no single, perfect digital archiving solution, the key to making our data last forever is good habits. We need to be vigilant, continually moving our data forward to new formats and keeping it on multiple devices—before whatever we have becomes obsolete or simply fails. The best protection we have against data loss is redundancy—and lots of it. William LeFurgy, manager of the National Digital Information Infrastructure and Preservation Program at the Library of Congress, says the most important thing everyone should do is make copies of data and store those copies in different locations.

The first of your backups should be on an external hard drive. Look for a desktop drive (desktop drives tend to be sturdier than portable ones) and make sure it has the most common input/output interface, USB. Warranties don't assure long life spans, but they're a good indicator of what to expect, so find a drive that's guaranteed for at least four or five years. Verbatim's 2 TB USB drive costs \$150 and has a seven-year warranty, and LaCie's d2 Quadra Enterprise Class 1 TB drive, \$300, is guaranteed for five years.

For long-term archival storage, the media most likely to last a century are gold-coated Blu-ray discs, thanks to a special protective layer, and film (negatives and video film, as well as microfilm). The promise of a century-long life span is like a good warranty, giving at least some reassurance that the product won't bite the dust a week after you start using it. A hundred years from now, though, you'll also need the hardware to read these media.

Unfortunately, unlike with paper archiving, you can't just put a disk or drive into a vault and hope to read it in a hundred years. How you store the media is important; magnetic disks need to be stored away from light and pollutants such as dust and at about 68 F with 40 percent relative humidity. And long-term storage on any one device or medium can leave you stranded with an unsupported format. Never get rid of hardware

Format Fatalism	 CD-R	 MAGNETIC HARD DRIVE	 SOLID-STATE DRIVE	 SDHC CARD	 BLU-RAY DISC
LIFE SPAN	2 to 5 years	3 to 7 years	10 years	10 years	10 to 15 years*
MAX CAPACITY	650 MB	3 TB	256 GB	4 GB to 32 GB	25 GB
PROS	Portable, cheap, and can be read by almost any modern computer. Those with gold or silver undersides last longest.	Large capacities, fast read/write speeds, can be used with programs that automatically sync files.	Low risk of mechanical failure because no moving parts, quick startup, virtually no file fragmentation.	Portable, no moving parts, can be read and written by many smartphones and cameras.	Unlike DVDs, required to meet a base level of scratch resistance, relatively cheap, can hold up to 25 GB per layer.
CONS	Fragile, degrades easily in extreme temperatures, can even be ruined just by markers (it's best to write on the clear center ring).	The constant spinning of a magnetic platter takes a toll on its health, and mechanical failure is inevitable.	Expensive, limited number of times each bit can be erased (and therefore can be written).	Easy to misplace, limited number of read/write cycles.	Fragile, degrades in heat and light unless it's a gold-coated archival disc.

*100 years with gold coating



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WITH EVERY AGE COMES RESPONSIBILITY. IMPORTANT SAFETY INFORMATION BELOW.

We know that no medicine is for everyone. Don't take VIAGRA if you take nitrates, often prescribed for chest pain, as this may cause a sudden unsafe drop in blood pressure.

Talk with your doctor first. Make sure your heart is healthy enough to have sex. If you have chest pain, nausea, or other discomforts during sex, seek medical help right away.

In the rare event of an erection lasting more than four hours, seek immediate medical help to avoid long-term injury.

In rare instances, men who take PDE5 inhibitors (oral erectile dysfunction medicines, including VIAGRA) reported a sudden decrease or loss of vision, or sudden decrease or loss of hearing. It is not possible to determine whether these events are related directly to these medicines or to other factors. If you experience any of these symptoms, stop taking PDE5 inhibitors, including VIAGRA, and call a doctor right away.

The most common side effects of VIAGRA are headache, facial flushing, and upset stomach. Less common are bluish or blurred vision, or being sensitive to light. These may occur for a brief time.

VIAGRA does not protect against sexually transmitted diseases including HIV.

Take VIAGRA about one hour before you want to have sex. VIAGRA works for 4 hours. VIAGRA only works with stimulation.

Please see Important Facts for VIAGRA on the following page or visit viagra.com for full prescribing information.

*Data taken from a study of 228 men with ED who previously had success with VIAGRA. Of the 115 men who took VIAGRA 100mg, 35% had erections hard enough for successful intercourse at 14 minutes, and 51% of men at 20 minutes.

Individual results may vary.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.FDA.gov/medwatch or call 1-800-FDA-1088.

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IMPORTANT FACTS

VIAGRA®
(sildenafil citrate) tablets

(vi-AG-rah)

IMPORTANT SAFETY INFORMATION ABOUT VIAGRA

Never take VIAGRA if you take any medicines with nitrates. This includes nitroglycerin. Your blood pressure could drop quickly. It could fall to an unsafe or life-threatening level.

ABOUT ERECTILE DYSFUNCTION (ED)

Erectile dysfunction means a man cannot get or keep an erection. Health problems, injury, or side effects of drugs may cause ED. The cause may not be known.

ABOUT VIAGRA

VIAGRA is used to treat ED in men. When you want to have sex, VIAGRA can help you get and keep an erection when you are sexually excited. You cannot get an erection just by taking the pill. Only your doctor can prescribe VIAGRA.

VIAGRA does not cure ED.

VIAGRA does not protect you or your partner from STDs (sexually transmitted diseases) or HIV. You will need to use a condom.

VIAGRA is not a hormone or an aphrodisiac.

WHO IS VIAGRA FOR?

Who should take VIAGRA?

Men who have ED and whose heart is healthy enough for sex.

Who should NOT take VIAGRA?

- If you ever take medicines with nitrates:
 - Medicines that treat chest pain (angina), such as nitroglycerin or isosorbide mononitrate or dinitrate
- If you use some street drugs, such as "poppers" (amyl nitrate or nitrite)
- If you are allergic to anything in the VIAGRA tablet

BEFORE YOU START VIAGRA

Tell your doctor if you have or ever had:

- Heart attack, abnormal heartbeats, or stroke
- Heart problems, such as heart failure, chest pain, or aortic valve narrowing
- Low or high blood pressure
- Severe vision loss
- An eye condition called retinitis pigmentosa
- Kidney or liver problems
- Blood problems, such as sickle cell anemia or leukemia
- A deformed penis, Peyronie's disease, or an erection that lasted more than 4 hours
- Stomach ulcers or any kind of bleeding problems

Tell your doctor about all your medicines. Include over-the-counter medicines, vitamins, and herbal products. Tell your doctor if you take or use:

- Medicines called alpha-blockers to treat high blood pressure or prostate problems. Your blood pressure could suddenly get too low. You could get dizzy or faint. Your doctor may start you on a lower dose of VIAGRA.
- Medicines called protease inhibitors for HIV. Your doctor may prescribe a 25 mg dose. Your doctor may limit VIAGRA to 25 mg in a 48-hour period.
- Other methods to cause erections. These include pills, injections, implants, or pumps.
- A medicine called REVATIO. VIAGRA should not be used with REVATIO as REVATIO contains sildenafil, the same medicine found in VIAGRA.

POSSIBLE SIDE EFFECTS OF VIAGRA

Side effects are mostly mild to moderate. They usually go away after a few hours. Some of these are more likely to happen with higher doses.

The most common side effects are:

- Headache
- Feeling flushed
- Upset stomach

Less common side effects are:

- Trouble telling blue and green apart or seeing a blue tinge on things
- Eyes being more sensitive to light
- Blurred vision

Rarely, a small number of men taking VIAGRA have reported these serious events:

- Having an erection that lasts more than 4 hours. If the erection is not treated right away, long-term loss of potency could occur.
- Sudden decrease or loss of sight in one or both eyes. We do not know if these events are caused by VIAGRA and medicines like it or caused by other factors. They may be caused by conditions like high blood pressure or diabetes. If you have sudden vision changes, stop using VIAGRA and all medicines like it. Call your doctor right away.
- Sudden decrease or loss of hearing. We do not know if these events are caused by VIAGRA and medicines like it or caused by other factors. If you have sudden hearing changes, stop using VIAGRA and all medicines like it. Call your doctor right away.
- Heart attack, stroke, irregular heartbeats, and death. We do not know whether these events are caused by VIAGRA or caused by other factors. Most of these happened in men who already had heart problems.

If you have any of these problems, stop VIAGRA. Call your doctor right away.

HOW TO TAKE VIAGRA

Do:

- Take VIAGRA only the way your doctor tells you. VIAGRA comes in 25 mg, 50 mg, and 100 mg tablets. Your doctor will tell you how much to take.
- If you are over 65 or have serious liver or kidney problems, your doctor may start you at the lowest dose (25 mg).
- Take VIAGRA about 1 hour before you want to have sex. VIAGRA starts to work in about 30 minutes when you are sexually excited. VIAGRA lasts up to 4 hours.

Don't:

- Do not take VIAGRA more than once a day.
- Do not take more VIAGRA than your doctor tells you. If you think you need more VIAGRA, talk with your doctor.
- Do not start or stop any other medicines before checking with your doctor.

NEED MORE INFORMATION?

- This is only a summary of important information. Ask your doctor or pharmacist for complete product information OR
- Go to www.viagra.com or call (888) 4-VIAGRA (484-2472).

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(computers, drives, readers, etc.) until you've moved the data onto the next storage media and confirmed that it can be read. Often that means copying not only files but also the programs, plug-ins, and drivers needed to read them. Have a bunch of already obsolete media lying around—VHS tapes, floppy disks, and even CDs? Rescue those files as soon as you can.

Choose your file formats carefully too. Open formats trump proprietary ones when it comes to longevity. Two decades from now, an Adobe Photoshop PSD file is far less likely to be compatible with the software of the future than an open format such as TIFF or JPEG. Likewise, plain-text files (.txt) are better than Microsoft Word's proprietary formats (.doc and .docx). Almost any type of text or image file can be turned into a PDF/A, a special type of PDF designed for archiving.

Perhaps the most critical step many of us forget is verifying that our data is recoverable. Animation studio Pixar almost lost a year's worth of work on *Toy Story 2* when someone mistakenly entered a Linux command (rm*) that wiped away the files in seconds. The company checked its backups only to discover that they had failed. Luckily, Pixar's technical director had been working from home, so the company was able to salvage the data from her personal computer. The moral: At least once a year, make sure your backups actually work.

Finally, after following all these steps to combat fragile media, tech obsolescence, and failed backups, there's one last hurdle: making sure your data can outlive you (if you want them to, that is). For that, rely on the same methods of digital redundancy and add in the analog—people and paper. Let family members know where your data are stored, how to access them, and what they should be looking for. And for documents you truly can't stand to lose, store copies digitally, but hold on to some additional copies in traditional form: on paper.

Digital Clinic

BY
RACHEL Z. ARNDT



Out With the Old Phone, In With the New

I have an iPhone 4, but now I want to get the new model. I've heard that I can sell the old one online and recoup some of the cost. Where do I get the best deal?



Every time the latest version of a smartphone or tablet arrives, a new market for the previous models arrives too. Some buyers hope they can get decent used smartphones for less money than brand-new ones, and others think the latest version is too small an upgrade to justify the higher price. If you strategize well, you can sell your old phone on this secondary market for a surprising amount of cash. But before you can sell it, you have to get it ready for its new owner by backing it up, erasing your data, and restoring the factory settings. To boost the phone's resale value, you might also consider using Ultrasn0w (a program available on iphone-dev.org) to unlock it so that it can work on different carriers. Unlocking is legal but won't work on all phones—Verizon and Sprint devices, which operate on the CDMA network, can't be

*Price for iPhone 5 includes a two-year cellular contract extension.



Popular Mechanics
READERS' CHOICE
AWARD 2011

Is Your Best-in-Class Ready for the Cold Weather Season?

For a car, the first few moments of a cold weather start create the highest risk of serious engine wear. One of the culprits is conventional engine oil, which becomes thick in freezing weather so it fails to properly lubricate engine parts quickly. There's one best in class solution to ensure your car gets started easily this winter: Mobil 1™ synthetic motor oil. It maintains its viscosity in temperatures as low as -40 degrees Fahrenheit so you won't get stranded as you head out to your New Year's Eve Party.



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DIY TECH / DIGITAL CLINIC

unlocked to work on AT&T and T-Mobile's GSM networks and vice versa. Finally, box up the phone in whatever original packaging you have left so it looks as close to new as possible.

Some electronics stores, among them Apple and RadioShack, have trade-in programs, and many websites serve as go-betweens for you and potential buyers. For gadgets such as the iPhone that cause near mayhem when new models come out, you need not look any further than Craigslist, where a few sentences including the state of your phone, your asking price, and any extra features—an intact warranty, for instance—will be enough to flood your inbox with emails from interested (and nearby) buyers. As of this writing, a 16 GB black AT&T iPhone 4 could fetch about \$150.

Electronics more than one or two generations older than the current version are tougher sells, but it's certainly not impossible. Amazon, Best Buy, and Gazelle all have programs that let you trade your gadgets in exchange for gift certificates. You rate the condition of your phone—perfect, good, or mediocre—then send it in for the service to verify your judgment and to receive a gift card. With Amazon's exchange service, if the phone is worth more than what you guessed, you'll get a gift certificate for the higher amount, and if you overestimated, Amazon gives you the option of taking the lower amount or not selling at all. Though all three programs are nearly identical in process, they aren't in results: At press time, Amazon offers the most for a 16 GB black AT&T iPhone 4—a "like new" phone will get you \$170 and a "good" one goes for \$145. Best Buy offers slightly lower amounts—\$152 for "perfect" and \$145 for "good." Gazelle is the cheapskate of the group, offering



ERIC BUTLER,
Security expert

ADVICE FROM AN EXPERT

HOW SAFE IS AIRPORT WI-FI?

In 2010 Eric Butler developed Firesheep, a Firefox extension that allowed anyone on a public network to access websites—including email and Facebook—visited by anyone else on that network, to demonstrate just how vulnerable public networks are. Firefox has since patched the vulnerabilities exploited by Butler's program, but we contacted him to find out how to protect oneself from prying programs such as his. "People should really avoid any service that requires them to log in unless that website is 100 percent secure," Butler says. "Anybody nearby can pretty much watch what you're doing unless the website is secure" [its URL will start with https, not http]. Even then, information such as bank accounts and passwords may not be completely hidden from prying eyes. So, for extra protection, Butler recommends using a virtual private network such as Cloak. "A VPN essentially moves the problem to someone else," he says. "It encrypts everything I'm doing from where I am all the way to wherever the VPN is running, which is somewhere in the cloud."

10

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just \$145 for a "flawless" phone and \$140 for a "good" one. Prices are bound to fluctuate as new models arrive, so it's still important to check all your options before choosing one.

The same services will work for much more than iPhones. If you have something really old, though, you might be better off giving eBay a shot. There, an obsolete-technology

collector may be just the match for your old Walkman.

Cross-Platforming

I'd like to install Windows 8 on my Mac. What's the best way to do it?

Mountain Lion and Windows 8 can live happily on one machine. There are two ways to get Win 8 running on a Mac.

To run Windows from startup, you'll need to install a bootable version of the OS using Apple's Boot Camp, a program that partitions the hard drive and gets your installation running (for the actual installation, you'll need to insert either a USB drive or a DVD with the install media on it). When you open Boot Camp, choose to both download and install support software.

After that, the program will run mostly on its own, pausing only to ask how large you'd like the Windows partition to be. If you're using the 64-bit version of Windows, give it at least 25 gigabytes. (You can always delete the partition later.)

You can also run Windows as a virtual machine—a fully functioning independent OS within another OS—with virtualization software. Parallels (\$80) is a good choice, but as with any virtualization program, it's not as fast as running Windows natively from a bootable partition. To get that kind of performance, plus the flexibility of virtualization, you can double up Boot Camp and Parallels. First, install Windows 8 via Boot Camp, thereby creating a separate partition. Then, choose the option in Parallels to treat the Boot Camp partition as a virtual machine. That way you can run a speedy Windows 8 whenever you want, without restarting first. No matter which method you choose, using Windows 8 on your Mac will be inherently finicky, especially because it relies so heavily on gestures. Hot corners on your Mac may override Windows when you're in virtualization software, for instance, and getting your bootable Windows to accept right clicks on trackpads requires special drivers. You'll get most of this support software with any up-to-date Boot Camp, and it's also available on Apple's website. **PopMech**

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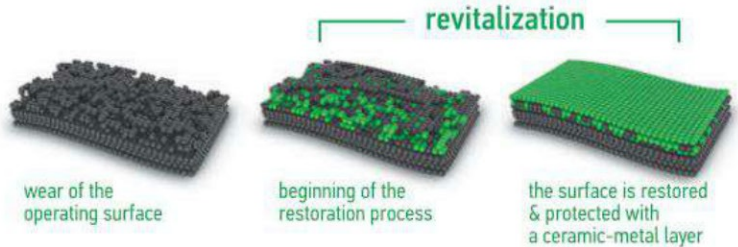
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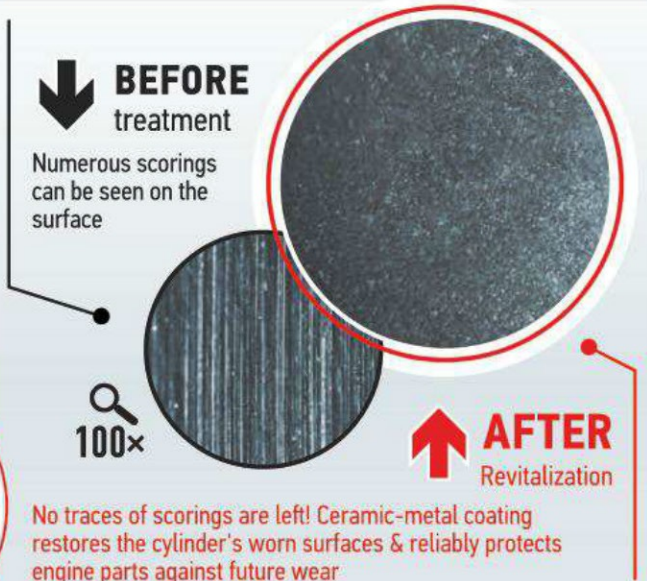


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redicting the future of the collectible car market is a tricky game. Some cars regularly make everyone's list of future classics, but those are no-brainers. Obscenely expensive supercars, beautifully designed luxury coupes, and beloved sports cars are easy picks—no one will be shocked when the Scion FR-S and Mercedes SLS AMG are sought after decades from now. Figuring out which ho-hum family cars, sales failures, and throwaway compacts will be loved makes for fun conversation. Nobody who bought a Ford Fairlane in 1966 thought it would one day be highly prized. The same goes for the Impala, Microbus, Datsun 510, and many other offbeat collector cars. With this in mind we've sifted through the past 20 years of mainstream production cars in an attempt to pinpoint the potentially valuable vehicles that might be affordable today—or in your garage right now. What are the factors we're using to make our picks? Novelty, rarity, historical significance, and, most important, the potential for nostalgia.



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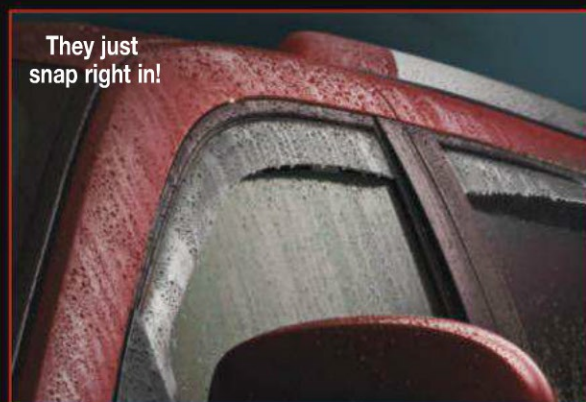
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HUMMER H2

Duesenbergs, El Caminos, and the Model T are emblems of their era. The Hummer H2 also falls squarely into that category. Little more than a butched-up Chevy Tahoe, the H2 was loved and hated in equal measure. The military-themed knockoff was a hit with individuals with a type A personality and a need for some conspicuous consumption. A huge tax loophole at the time made it a corporate write-off for everyone from hip-hop stars to construction bosses. When the bottom fell out of the economy in 2008 and green motoring became popular, the 8-mpg Hummer was vilified, becoming a poster child for everything wrong with GM and the decade. Just as suicide-door Continentals and fin-tail Cadillacs embodied the 1960s, nothing says 2000s like a bright red Hummer H2.

CADILLAC ELDORADO

There is something about a Cadillac, especially the big two-door personal luxury cars. The Eldorado lived a nice long life before it was put out to pasture in 2002, and the final version was a beauty: a 300-hp Northstar V-8, crisp, tuxedo-like styling, and a high-tech but handsome interior that just didn't click with consumers more interested in SUVs. Its timeless styling and low production numbers will likely make it a classic.



× Pontiac Aztek

How would a car that regularly tops lists of the ugliest vehicles ever built end up on a list of collectibles? Because of the Edsel—the previous most-hated entry is now a highly collectible classic. Call it a bizarre nostalgia for the ugly duckling. Combine aesthetic infamy with the likelihood that most examples will end up recycled into tin cans and you've got the makings of a collectible.



SECOND-GENERATION TOYOTA PRIUS

Love it or loathe it, the second-generation Prius was the car that made the hybrid market. Sales of Toyota's egg-shaped nerdmobile spiked as gas prices soared, making the Prius an automotive icon. The second generation isn't a driver's car, but it sure as heck gets good mileage. For the better part of the next decade and beyond, it set the benchmark other automakers aim for.



CHRYSLER MAGNUM

Will we ever tire of radical station wagons? No. The Magnum was a gamble for Chrysler when first introduced. It had huge passenger and cargo space, engine options galore, a cool look, and an innovative hatch that made loading incredibly easy. Unfortunately, buyers at the time didn't appreciate this brilliant product and it died shortly after its only refresh. The high-powered SRT-8 versions will be especially prized.

W

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SCION xB

Take conventional styling wisdom out to the shed and beat it with a carpenter's square: that's the Scion xB, a Japanese import that mocked the jellybeanification of mainstream cars. Its right angles afforded maximum interior space and gave it critical antistyle street cred. Toyota aimed it at the youth market, but middle-agers and seniors bought it for its price, space, and fuel efficiency. Geeky and counterculture enough to be collected.



Isuzu VehiCross ×

There's a distinct possibility Isuzu will be out of business as of this printing, and the SUV that's easily its most outrageous offering—the VehiCross—will be somewhat collectible. Probably the purest concept car to hit series production since the Viper or Prowler, and, in spite of brilliant styling, sales were in the toilet. Regardless, you can't see a VehiCross and not do a double take.

PLYMOUTH NEON

When introduced in 1995, the Plymouth Neon recast the small-car segment as an acceptable form of transportation rather than a necessity of working-class budgets. We're limiting this pick to the extremely rare launch livery version: white with five-bubble hubcaps and a roof rack made famous in the "Hi" commercials. Rust claimed many, and with the numbers that were made, these cars are rare to the point of comedy. In a nationwide search we turned up zero examples for sale.



HONDA INSIGHT

Two seats and an Atkinson cycle four-cylinder, an absolute obsession with weight and aerodynamic performance—that's the first Insight. The dedication to fuel economy created a car that could exist for only a moment in history. The Insight basically invented all of the ideas we take for granted in hybrids. Is it sexy or practical? No. But it's a no-holds-barred, super-duper hybrid with a nothing-sacred approach to engineering. As the paterfamilias of the breed, it seems like an obvious choice for collectibility.

JAGUAR XJR



When Jaguar realized it had become a car company for old men in floppy hats, it reengineered its flagship car and styled it for old men in floppy hats but made it out of aluminum. If it had been released in a vacuum it would have been successful, but it wasn't, and it wasn't. Still, the lightweight XJ was a great car, and the refreshed XJR version was even better. Jaguar values tend to rebound over a very, very long time frame.

W

WEEKEND

Chicago Doctor Invents Affordable Hearing Aid Outperforms Many Higher Priced Hearing Aids

Reported by J. Page

CHICAGO: A local board-certified Ear, Nose, Throat (ENT) physician, Dr. S. Cherukuri, has just shaken up the hearing aid industry with the invention of a medical-grade, affordable hearing aid. This revolutionary hearing aid is designed to help millions of people with hearing loss who cannot afford—or do not wish to pay—the much higher cost of traditional hearing aids.

**"Perhaps the best quality-to-price ratio in the hearing aid industry" – Dr. Babu, M.D.
Board Certified ENT Physician**

Dr. Cherukuri knew that untreated hearing loss could lead to depression, social isolation, anxiety, and symptoms consistent with Alzheimer's dementia. He could not understand why the cost for hearing aids was so high when the prices on so many consumer electronics like TVs, DVD players, cell phones and digital cameras had fallen.

Since Medicare and most private insurance do not cover the costs of hearing aids, which traditionally run between \$2000-\$6000 for a pair, many of the doctor's patients could not afford the expense. Dr. Cherukuri's goal was to find a reasonable solution that would help with the most common types of hearing loss at an affordable price, not unlike the "one-size-fits-most" reading glasses available at drug stores.

He evaluated numerous hearing devices and sound amplifiers, including those seen on television. Without fail, almost all of these were found to amplify bass/low frequencies (below 1000 Hz) and not useful in amplifying the frequencies related to the human voice.

Inspiration from a surprising source

The doctor's inspiration to defeat the powers-that-be that kept inexpensive hearing aids out of the hands of the public actually came from a new cell

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phone he had just purchased. "I felt that if someone could devise an affordable device like an iPhone® for about \$200 that could do all sorts of things, I could create a hearing aid at a similar price."

Affordable Hearing Aid With Superb Performance

The high cost of hearing aids is a result of layers of middlemen and expensive unnecessary features. Dr. Cherukuri concluded that it would be possible to develop a medical grade hearing aid without sacrificing the quality of components. The result is the MDHearingAid PRO®, starting well under \$200. It has been declared to be the best low-cost hearing aid that amplifies the range of sounds associated with the human voice without overly amplifying background noise.

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The MDHearingAid PRO® has been rigorously tested by leading ENT physicians and audiologists who have unanimously agreed that the sound quality and output in many cases exceeds more expensive hearing aids.

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—Gerald Levy

"I have a \$2,000 Resound Live hearing aid in my left ear and the MDHearingAid PRO® in the right ear. I am not able to notice a significant difference in sound quality between the two hearing aids."
—Dr. May, ENT Physician

"We ordered two hearing aids for my mother on Sunday, and the following Wednesday they were in our mailbox! Unbelievable! Now for the best part—they work so great, my mother says she hasn't heard so good for many years, even with her \$2,000 digital! It was so great to see the joy on her face. She is 90 years young again."—Al Peterson

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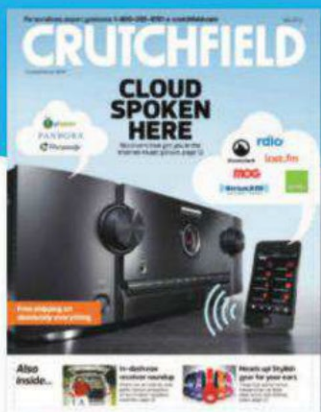
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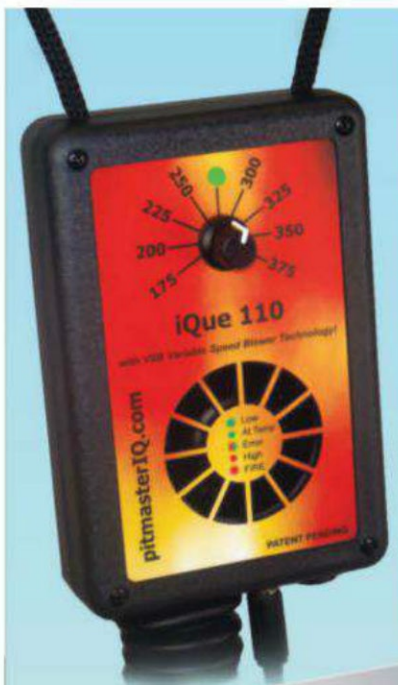
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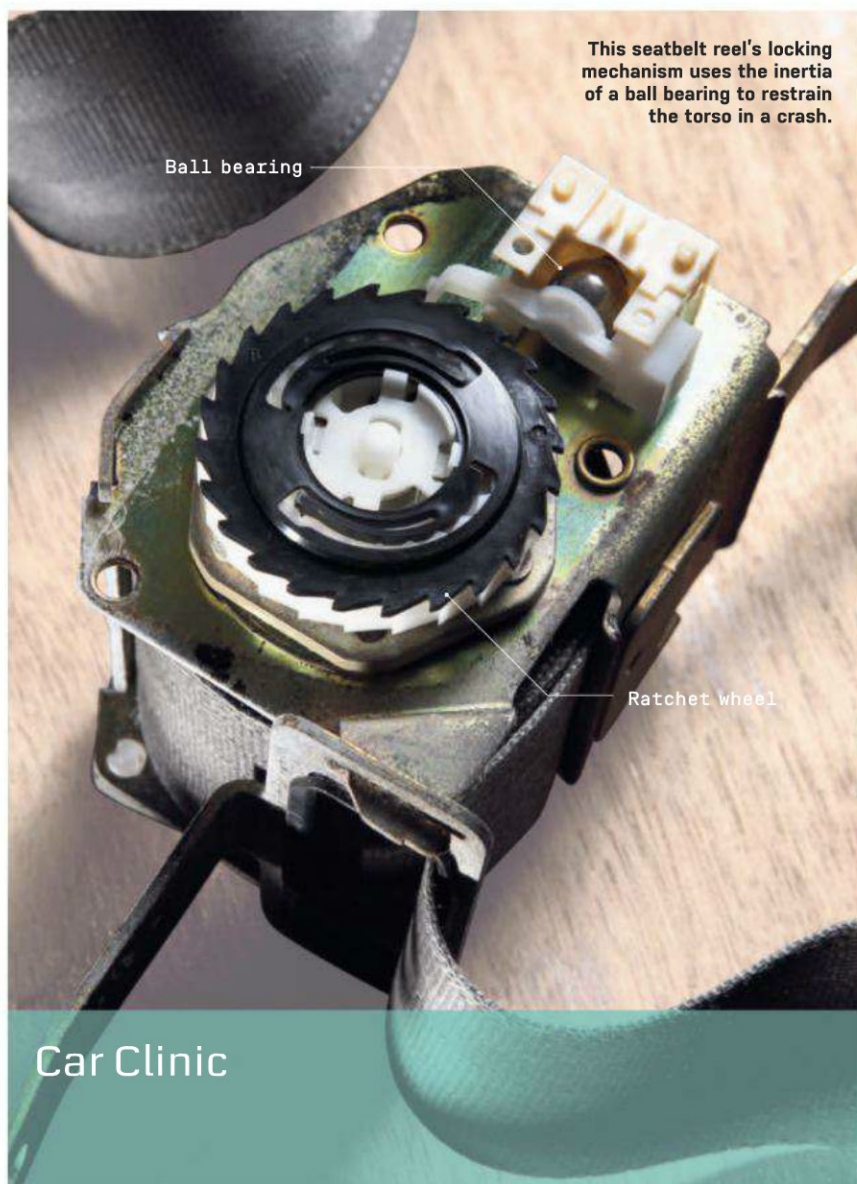
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Seatbelt Tension

The seatbelts in my '96 Toyota Corolla lock up when I get in the car and try to pull them out. I'll go to fasten my belt, but it won't extend more than an inch, and I have to tug dozens of times. Sometimes it takes me 10 or 15 minutes to buckle up. Please help!



After pulling the mechanism off a similar model year Corolla in the junkyard and examining how it works, I see two things that could explain your issue. The first and most easily remedied is the spot where you park the car. Toyota's mid-'90s belt-locking mechanism relies on the inertia of a ball bearing in a shallow plastic cup to move a small plastic lever. In a fast stop, that bearing rides up in the cup and raises the lever, engaging a ratchet mechanism and locking the belt. This system is very sensitive to the attitude of the car, so if you park the car facing downhill or uphill or tilted sideways, the lever will engage the belt lock.

The other possibility is contamination. The protective housing is not airtight, and if you do a lot of dusty driving, the cup or the bearing could easily become caked with dirt over the years; that could keep the bearing from rolling properly. Address this by popping the trim off the B-pillar and then unbolting the seatbelt recoil mechanism from the car (it's just one bolt). Pry the lock mechanism's protective translucent cover loose with a standard screw-

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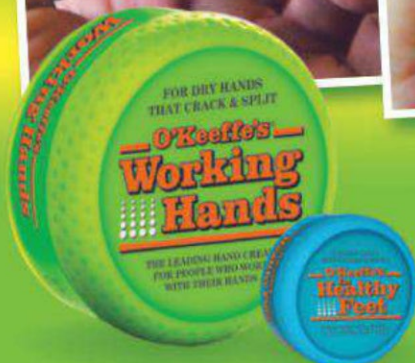
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driver, and then clean the cup and the bearing with a soap-and-water solution. Let it dry thoroughly, and reinstall the mechanism with a dab of Loctite on the threads of the retaining bolt. Test the belt to see if it works. If it's still stubborn, order a new one from the dealership and replace the whole seatbelt as a unit—there's no need to entrust your safety to a compromised device.



**GOT A CAR PROBLEM?
ASK BEN ABOUT IT.**

Send your questions to pmautoclinic@hearst.com or over Twitter at twitter.com/PopMechAuto or to Car Clinic, Popular Mechanics, 300 W. 57th St., New York, NY 10019-5899. While we can't answer questions individually, problems of general interest will be discussed in the column.

A Great Bad Idea

I've recently come into the market for a small, cool, sporty car and found a red 1976 Fiat 124 Sport Spider with a four-cylinder engine, five-speed manual, and a fairly nice body. But the interior looks pretty bad. The floors are rusty, carpet is missing, the seats are in tatters, and the windscreen needs to be replaced. The dealer is asking \$3500, but I believe I can talk him down. Would buying this car and fixing it up be worth it in the end?

As a connoisseur and collector of rusty-but-lovable old cars (two of mine also have see-through floors), I can enthusiastically tell you that yes, it's totally worth it to fix up a '70s-era Italian money pit . . . but I say that with enormous caveats. First, you have to accept that buying and fixing old cars will probably never make you money—quite the reverse, actually. (You'll be amazed by how low this car scores in PM's free Used Car Checklist iPhone app.) The weirder and rarer the car, the more elusive and expensive its parts. Fiat sold nearly 200,000 124s in the U.S., so they aren't seriously rare, but parts can be difficult to source. What you saw in your initial inspection is just a hint of what will actually need to be repaired. The floor and seats are probably the least of your worries. New floor panels are available for this car and can be welded in at home if you have the skill or by any body shop. Same goes for the seats—take 'em to an upholstery shop and sign a check. They'll come back good as new. The carpet is cheap and simple to install while the seats are out.

What's really going to kill you are the unknowns: the rear main seal that's just waiting for a nice fall day to let go; crank bearings waiting to spin; transmission synchros chewed to bits; bushings in the suspension

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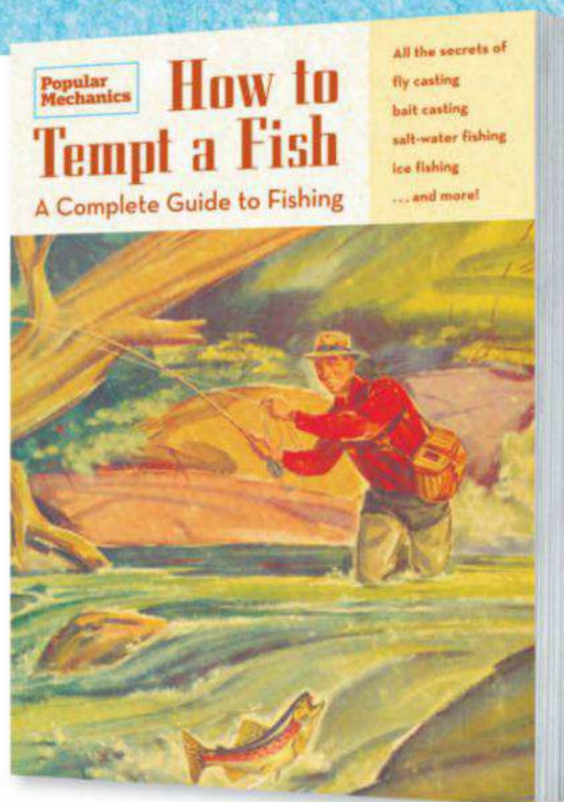
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crumbling; a fuel pump right on the edge of failing. Owning an old car is an exercise in patience and resolve. Before you take the plunge, ask yourself a few questions: Do I have garage space I'm willing to sacrifice indefinitely? Is my significant other willing to tolerate my many evenings in the garage? Is my bank account due for some exercise? All that said, there is no greater motoring experience than an evening drive in a car you've brought back from near death.

The Sap Problem

A pine tree at work dropped a few nickel-size sap spots onto my 2011 Jeep Grand Cherokee. I tried to get them off with hot water and carwash soap, but no luck. I fear the sap is baked into the clear coat after several months in the sun. I considered using Goo Gone, but I'm worried about taking off the paint. What do you recommend?

Your sap problem is a common one and something I've dealt with before. I recommend Goo Gone or Turtle Wax Bug & Tar & Tree Sap Remover. What I don't suggest is an old dishrag, scrubbing detergent, and all the elbow grease you can muster. Those results will be less than satisfactory. Both the Goo Gone and Turtle Wax are surprisingly nonreactive to the paint and clear coat and will take off the sap quickly and cleanly, without much effort. That's not to say there won't be any damage to the clear coat: You might see some ghostly outlines where the sap was. If you have this damage, take a microfiber towel and a light-cut rubbing compound to the area, using moderate pressure in overlapping circles to work the damage out of the clear coat. Lay down a good final polish or wax over the entire area and you'll never know there was a problem.

Fading Pixels

The Driver Information Center in my 1998 Corvette Indy Pace Car has slowly dimmed to unreadable over the years. What the heck is causing this and how do I fix it?

This is a common issue with older cars that have LED-based gauge clusters. The problem is one of chemistry, not electronics. The light-emitting diode is a type of display-system-electronics element that can be arranged in low-resolution pixel format to show information to the driver. Unfortunately, LED displays from the 1980s into the 2000s were not as good as what we have today. Over years and years of thermal cycling, the chemistry in the diodes breaks down, and the result is dwindling light output. This low output is worse on hot days; on cold days part or all of the readout might work again. A temporary solution would be to replace some resistors in the instrument cluster to increase the voltage to the LED panel, but that would result in accelerated failure of the remaining good pixels. Your only solid fix is to have an aftermarket repair house install a new LED panel or get a new old stock part, which means the entire gauge cluster. The former is cheaper than the latter if you can find a good shop, but there's really no way to fix this yourself. **PopMech**

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SUPER COUPON!

US★GENERAL
PNEUMATIC ADJUSTABLE ROLLER SEAT

LOT NO. 46319

SAVE 33%

\$1999

REG. PRICE \$29.99

300 LB. CAPACITY

52134283

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SUPER COUPON!

CENTRALPNEUMATIC
20 OZ. GRAVITY FEED SPRAY GUN

LOT NO. 47016/67181

SAVE 66%

\$999

REG. PRICE \$29.99

Item 47016 shown

38721704

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SUPER COUPON!

drillmaster
18 VOLT CORDLESS 3/8" DRILL/DRIVER WITH KEYLESS CHUCK

LOT NO. 68239/69651

SAVE 46%

\$1599

REG. PRICE \$29.99

Includes one 18V NiCd battery and charger.

Item 68239 shown

47597903

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SUPER COUPON!

CHICAGO ELECTRIC WELDING
ADJUSTABLE SHADE AUTO-DARKENING WELDING HELMET

LOT NO. 46092

SAVE 47%

\$3699

REG. PRICE \$69.99

30421651

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SUPER COUPON!

CHICAGO ELECTRIC WELDING
MIG-FLUX WELDING CART

LOT NO. 69340/90305

SAVE 41%

\$3499

REG. PRICE \$59.99

Welder and accessories sold separately.

Item 69340 shown

11243634

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SUPER COUPON!

THUNDERBOLT solar
45 WATT SOLAR PANEL KIT

LOT NO. 68751/90599

SAVE \$90

\$13999

REG. PRICE \$229.99

Item 68751 shown

61038033

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SUPER COUPON!

LOW-PROFILE CREEPER

LOT NO. 2745/69094

SAVE 52%

\$1899

REG. PRICE \$39.99

300 LB. CAPACITY

Tools sold separately.

Item 2745 shown

21476641

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SUPER COUPON!

CENTECH
NON-CONTACT INFRARED THERMOMETER WITH LASER TARGETING

LOT NO. 96451/69465

SAVE 58%

\$2499

REG. PRICE \$59.99

Requires two AAA batteries (sold separately).

Item 69465 shown

4814659948

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ON ALL HAND TOOLS!

SUPER COUPON!

Item 91616 shown



3 PIECE TITANIUM NITRIDE COATED HIGH SPEED STEEL STEP DRILLS

drillmaster

LOT NO. 91616/
60379/69087

SAVE 60%

\$7.99 REG. PRICE \$19.99



HARBOR FREIGHT TOOLS - LIMIT 9

Good at our stores or website or by phone. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 3/13/13. Limit one coupon per customer per day.

SUPER COUPON!

SAVE 53%



9 PIECE FULLY POLISHED COMBINATION WRENCH SETS

PITTSBURGH

SAE | METRIC

LOT NO. 42304/
69043 | LOT NO. 42305/
69044

Item 42304 shown

YOUR CHOICE!
\$6.99 REG. PRICE \$14.99

HARBOR FREIGHT TOOLS - LIMIT 7

Good at our stores or website or by phone. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 3/13/13. Limit one coupon per customer per day.

SUPER COUPON!

CENTRALPNEUMATIC AIR ANGLE DIE GRINDER

LOT NO. 32046/69945



SAVE 50%

\$9.99

REG. PRICE \$19.99

HARBOR FREIGHT TOOLS - LIMIT 8

Good at our stores or website or by phone. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 3/13/13. Limit one coupon per customer per day.

SUPER COUPON!

3/8" AIR RATCHET WRENCH

LOT NO. 47706/47214/60631

SAVE 40%



\$14.99 REG. PRICE \$24.99



HARBOR FREIGHT TOOLS - LIMIT 5

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SUPER COUPON!

CHICAGO ELECTRIC POWER TOOLS



OSCILLATING MULTIFUNCTION POWER TOOL

Accessories sold separately.

8 Functions: Sanding, Cut Flooring, Cut Metal, Scrape Concrete, Remove Grout, Cut Plastic, Scrape Flooring, Plunge Cut

SAVE 73% LOT NO. 68861/
68303/60428

\$15.99 REG. PRICE \$59.99

HARBOR FREIGHT TOOLS - LIMIT 6

Good at our stores or website or by phone. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 3/13/13. Limit one coupon per customer per day.

SUPER COUPON!

18 PIECE T-HANDLE BALL POINT AND HEX KEY WRENCH SET

PITTSBURGH

LOT NO. 96645



SAVE 33%

\$11.99

REG. PRICE \$17.99

HARBOR FREIGHT TOOLS - LIMIT 4

Good at our stores or website or by phone. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 3/13/13. Limit one coupon per customer per day.

SUPER COUPON!

US*GENERAL 16" x 30" STEEL SERVICE CART

LOT NO. 5107/60390

220 LB. CAPACITY

SAVE 37%



\$27.99

REG. PRICE \$44.99

HARBOR FREIGHT TOOLS - LIMIT 4

Good at our stores or website or by phone. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 3/13/13. Limit one coupon per customer per day.

SUPER COUPON!

1500 WATT CONTINUOUS/3000 WATT PEAK POWER INVERTER

LOT NO. 93280



SAVE \$40

\$119.99

REG. PRICE \$159.99

HARBOR FREIGHT TOOLS - LIMIT 4

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SUPER COUPON!

4000 LB. CAPACITY CABLE WINCH PULLER

LOT NO. 30329/69854



SAVE 48%

\$12.99

REG. PRICE \$24.99

HARBOR FREIGHT TOOLS - LIMIT 4

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SUPER COUPON!

CENTRAL PNEUMATIC HEAVY DUTY RETRACTABLE AIR HOSE REEL WITH 3/8" x 25 FT. HOSE

LOT NO. 46104/
69234/69266

SAVE 42%

\$39.99

REG. PRICE \$69.99



HARBOR FREIGHT TOOLS - LIMIT 3

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SUPER COUPON!

BADLAND WINCHES

2000 LB. ELECTRIC WINCH WITH REMOTE CONTROL AND AUTOMATIC BRAKE

\$49.99 REG. PRICE \$99.99

SAVE \$50

LOT NO. 68146

HARBOR FREIGHT TOOLS - LIMIT 5

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SUPER COUPON!

CENTRALPNEUMATIC 3 GALLON, 100 PSI OILLESS PANCAKE AIR COMPRESSOR

LOT NO. 95275/69486/
60637



SAVE 50%

\$39.99

REG. PRICE \$79.99

HARBOR FREIGHT TOOLS - LIMIT 3

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SUPER COUPON!

1500 LB. CAPACITY

SUPER-WIDE TRI-FOLD LOADING RAMP

HaulMaster

LOT NO. 90018/
60334/69595

\$69.99

REG. PRICE \$144.99



SAVE \$75

Item 90018 shown

HARBOR FREIGHT TOOLS - LIMIT 3

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SUPER COUPON!

1500 LB. CAPACITY MOTORCYCLE LIFT

Central Hydraulics

LOT NO. 2792/
69995/60536



SAVE \$50

\$69.99

REG. PRICE \$119.99

HARBOR FREIGHT TOOLS - LIMIT 4

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SUPER COUPON!

10 FT. x 17 FT. PORTABLE GARAGE

LOT NO. 68217/69039



Item 69039 shown

SAVE \$110

\$189.99

REG. PRICE \$299.99

HARBOR FREIGHT TOOLS - LIMIT 5

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SUPER COUPON!

CENTECH
AUTOMATIC BATTERY FLOAT CHARGER

LOT NO. 42292/69594/69955

SAVE 61%

Item 42292 shown

\$4.99 REG. PRICE \$12.99

50645491

HARBOR FREIGHT TOOLS - LIMIT 5

SUPER COUPON!

12" COMBINATION SQUARE SET
PITTSBURGH

LOT NO. 92471

SAVE 50%

\$4.99 REG. PRICE \$9.99

89549169

HARBOR FREIGHT TOOLS - LIMIT 7

SUPER COUPON!

8-IN-1 SOCKET WRENCHES
PITTSBURGH

YOUR CHOICE!

SAVE 40%

\$8.99 REG. PRICE \$14.99

SAE LOT NO. 65498 METRIC LOT NO. 65497

19853304

HARBOR FREIGHT TOOLS - LIMIT 8

SUPER COUPON!

3 TON HEAVY DUTY JACK STANDS
PITTSBURGH

LOT NO. 38846/69597

SAVE 54%

\$15.99 REG. PRICE \$34.99

58490714

Item 38846 shown

HARBOR FREIGHT TOOLS - LIMIT 5

SUPER COUPON!

CHICAGO ELECTRIC POWER TOOLS
RECIPROCATING SAW WITH ROTATING HANDLE

LOT NO. 65570

SAVE 50%

\$19.99 REG. PRICE \$39.99

78651753

HARBOR FREIGHT TOOLS - LIMIT 6

SUPER COUPON!

29 PIECE TITANIUM NITRIDE COATED DRILL BIT SET
drillmaster

LOT NO. 5889

SAVE 60%

\$9.99 REG. PRICE \$24.99

39345585

HARBOR FREIGHT TOOLS - LIMIT 8

SUPER COUPON!

CHICAGO ELECTRIC POWER TOOLS
10" SLIDING COMPOUND MITER SAW

LOT NO. 98199/69681

SAVE \$65

Item 98199 shown

\$84.99 REG. PRICE \$149.99

45153291

HARBOR FREIGHT TOOLS - LIMIT 4

SUPER COUPON!

CHICAGO ELECTRIC POWER TOOLS
ELECTRIC CHAIN SAW SHARPENER

LOT NO. 68221/93213

SAVE 40%

\$29.99 REG. PRICE \$49.99

13657469

Item 68221 shown

HARBOR FREIGHT TOOLS - LIMIT 5

SUPER COUPON!

Bunker Hill Security
36 LED SOLAR SECURITY LIGHT

LOT NO. 98085/69644/69890/60498

SAVE 28%

Item 98085 shown

\$17.99 REG. PRICE \$24.99

23182883

HARBOR FREIGHT TOOLS - LIMIT 4

SUPER COUPON!

60" WORKBENCH WITH 4 DRAWERS
WINDSOR DESIGN

LOT NO. 93454/69054

SAVE \$90

Item 93454 shown

\$139.99 REG. PRICE \$229.99

78282516

HARBOR FREIGHT TOOLS - LIMIT 3

SUPER COUPON!

CENTECH
DIGITAL INSPECTION CAMERA

LOT NO. 67979

SAVE \$50

Requires four AA batteries (included).

\$69.99 REG. PRICE \$119.99

78457643

HARBOR FREIGHT TOOLS - LIMIT 5

SUPER COUPON!

CHICAGO Electric Generators
800 WATT/900 MAX. WATTS PORTABLE GENERATOR

LOT NO. 66619/69381/60338

SAVE \$90

Item 66619 shown

\$89.99 REG. PRICE \$179.99

57662654

HARBOR FREIGHT TOOLS - LIMIT 3

SUPER COUPON!

1/2" INDUSTRIAL QUALITY SUPER HIGH TORQUE IMPACT WRENCH
CENTRAL EARTH PNEUMATIC

LOT NO. 68424/2623

SAVE \$50

Item 68424 shown

\$69.99 REG. PRICE \$119.99

25432070

HARBOR FREIGHT TOOLS - LIMIT 3

SUPER COUPON!

500 LB. CAPACITY DELUXE CARGO CARRIER
HaulMaster

LOT NO. 66983/69623

SAVE \$50

Item 66983 shown

\$49.99 REG. PRICE \$99.99

68649736

HARBOR FREIGHT TOOLS - LIMIT 4

SUPER COUPON!

6.5 HP OHV HORIZONTAL SHAFT GAS ENGINES (212 CC)
PREDATOR ENGINES

LOT NO. 68120/60363/69730

SAVE \$80

Item 68120 shown

\$99.99 REG. PRICE \$179.99

54647148

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"Your joints, lungs, and athleticism will love it!"
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About John Ellis... The 82 year old inventor is a Choate School and Lafayette College Engineering graduate. At just 17 years old, he invented a scientific measuring device that is still used worldwide. After working as an Oil Well Engineer, a Design Engineer at Douglas Aerospace and Honeywell Engineer, he started his own business at age 30 and invented a switch that operates (on-off) within .0001 of an inch. Honeywell and Military/Industrial users say, "He's the only person that knows how to produce it!" Likewise, textbook science claim "You can't change water properties" but

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NOW, AFTER BUILDING A BOTTLING OPERATION, WE OFFER FREE SAMPLES OF OUR WATER SO NOBODY CAN ARGUE WITH THE RESULTS i.e. Scientists measure the Hydrogen Bond Angle (113.8 degrees rounded off to 114 degrees) using a Tunneling Electron Microscope. A child can use fulvic acid (a nutrient) to see the Water Property change! LOOK AT THE EVIDENCE OF THE SUCCESSFUL RESULTS...the superimposed picture of the Gatehouse Entrance to our 418 acre \$100 million property on top of a mountain we bought overlooking the Delaware River that is being donated to further Cancer Research! The machines make "light" distilled or "light" tap water with the same health benefits!! WATCH THE VIDEO! After stating: "An otherwise respectable science magazine...", a former "Chem1" prof was told to REMOVE his website University picture and STATE "His Chemistry courses are NOT endorsed". Scientists also debunked him point by point! UCLA MEDICAL SCHOOL PROFESSOR years ago: "We can measure the ability of Blood (94% water) to go through a membrane into the cells to the extremities.

Nothing is even close to your water! Your Hydrogen Bond Angle is 114 degrees!" i.e. Diabetics. Regulators let us use this because they can measure Blood Flow non-invasively on the SKIN (Doppler Ultrasound)!! ONCOLOGIST (our website): "I just retired from Sloan Kettering after 30 years. I no longer have access to your machines. Send me an E5!" Who would know better than Elmer Bobst, founder of Warner Lambert (Lipitor) now Pfizer, The American Cancer

Society and what his world famous friend (We didn't know his background!), CIA Operative and Director of Sales Baron Otto von Bolschwing said at social gatherings at the home of John Ellis 50 years ago: "Millions of people will get cancer as soon as a MIXTURE of Drugs and latent Disease markers are flushed into the ground water! Ordinary water products are useless! The only home product that will work must 1) Change the Properties of water and 2) Subject water to intense ultraviolet radiation and heat 100's of times per gallon (NOT ONCE!!)" Watch the machine operate! You can see that's what he has done!! THEY WERE RIGHT! The mixture of 57 Drugs flushed into ground water aquifers that are now found in our spring water, bottled water and well water have spread to our municipal water systems (Associated Press 3/10/08)! AGRICULTURAL: DOLE FOODS. 9 months of testing with a 7 page contract (on file). PICTURES of root growth 6 TIMES that of any other water (with a wider Bond Angle, water goes through the fibrous membrane easier)! THOUSANDS of wells have been done with ONLY 10 gallons of water (usually lasts for years)! Hydrogen can power your car. You can release the POWER of hydrogen on even huge volumes of water! PUBLISHED PICTURES: Corn 22' high, 28" ears! *WASHINGTON POST Investigative Article 1/27/92: "10,000 people/day went to Mexico for months, Said to cure anything, Curative Power results in movements of water etc". Mexican Patent 239719 (the patented "movements" but not the results i.e. the proprietary Bond Angle change). WATER PURIFICATION: We have the ONLY home water product that can MAKE PURE WATER (Lab Standard: Pure Water is 0.1 ppm). YORK LABS MACHINE TESTS (our website): "less than" 0.07 ppm! 827 times purer than the local tap water. The largest selling home distiller only 9 times purer (we just started in business). CORNING: "Your water tests using Start-Stop boiling to lower steam velocity are better than ours!" MUNICIPAL: "Untreatable" e-coli waste lagoon (works on your septic), \$10,000/day in State fines. Saved taxpayers millions (Town letterhead). A major city didn't need expensive chemicals that get into the ground water (both on our website)!

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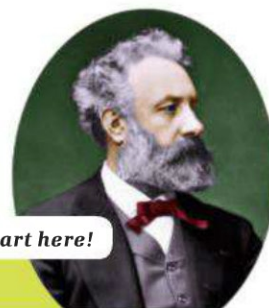
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○ **1904**
Jules Verne's *Master of the World* features the Terror—a boat, car, and aircraft that “dart[s] through space with a speed . . . superior to that of the largest birds.”



○ **1917** The Model 11 Autoplane debuts at New York's Pan-American Aeronautic Exposition. No record that it flew exists.

○ **1921**
The Tampier Roadable biplane lands at the Paris Air Salon and takes a 2-hour, 15-mph drive in the city.

○ **1938**
Robert A. Heinlein's *For Us, The Living: A Comedy of Customs* includes ovoid flying vehicles with wings and helicopter rotors.

○ **1947**
Henry Dreyfuss's ConvAirCar—a fiberglass-bodied automobile with a wing-and-propeller module attached to the roof—crashes during a test flight. The fatal wreck also kills the car's prospects for production.

○ **1953**
Leland Bryan of Buick flies his Autoplane, which is powered by a rear propeller while driving and flying. Bryan dies in 1974 when he crashes a version of it at an air show.



○ **1982**
In the dystopian film *Blade Runner*, oppressive police patrol aloft in vehicles called Spinners.



○ **1973**
Henry Smolinski mates a Ford Pinto with a Cessna Skymaster—and dies in a test-flight crash along with pilot Harold Blake.

○ **2011**
The first flight of the M400X Skycar is scuttled; it's another miscue by inventor Paul Moller, who has been trying to get a car airborne since the 1970s.



○ **2009**
PopMech gives a Breakthrough Award to the Maverick, a flying dune buggy that delivers medicine to remote areas.

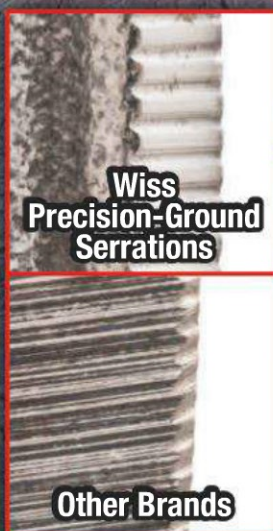
○ **2012**
The Terrafugia Transition “street legal” plane completes its first test flight in upstate New York.



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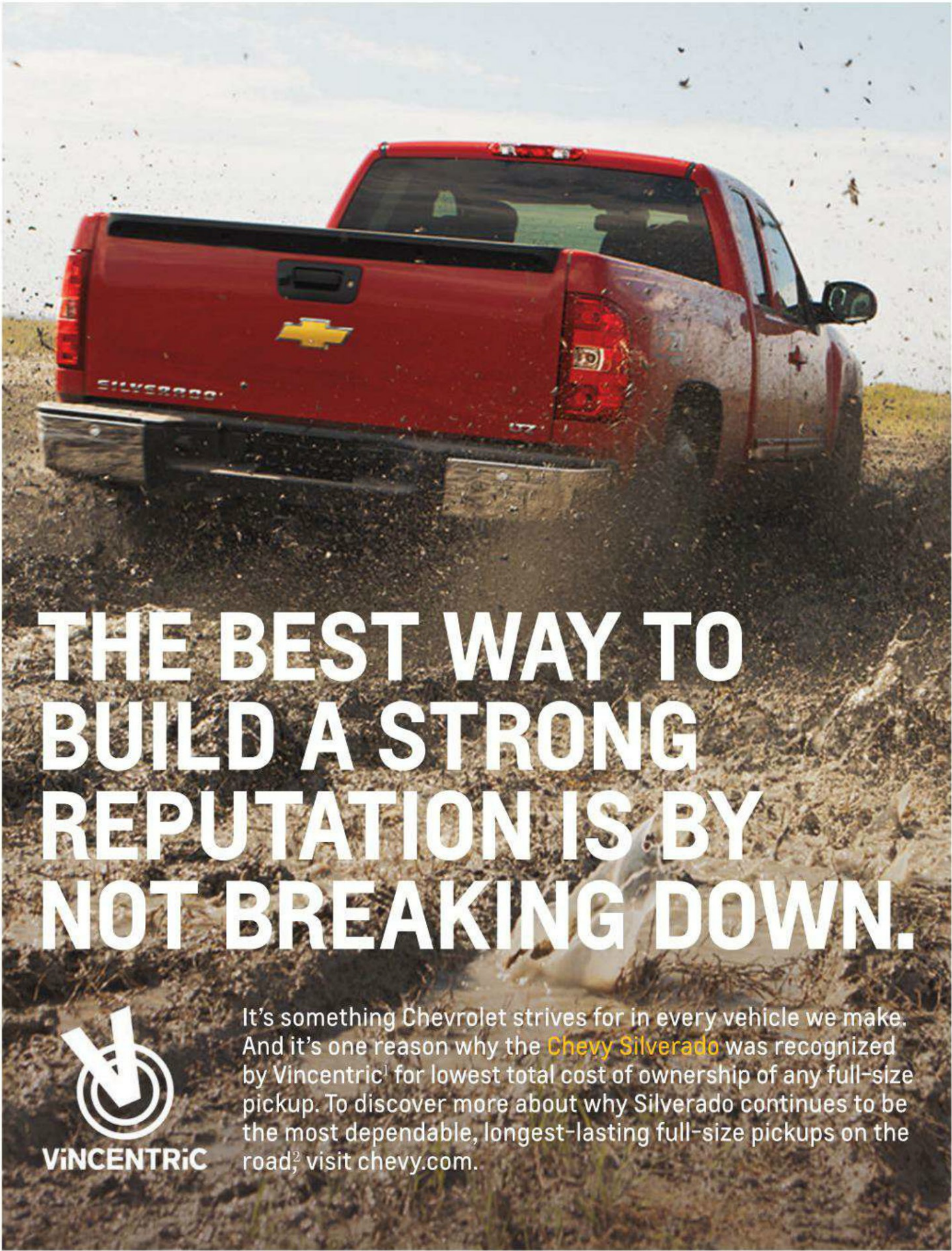
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¹ Based on 2012 Vincentric U.S. Model Level Analysis of full-size pickups in the retail market. ² Dependability based on longevity: 1981-July 2011 full-size pickup registrations.

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