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JUNE '05

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FEATURES

BEST IN THE WEST: "The Pacific Coast Highway," says PM editor Ben Stewart, "is a road to take when you love to drive."

COVER BY NASA; HOME DEPOT COVER BY DAN SAELINGER; PHOTOGRAPH BY JENNIFER ROCHOLL/NEGATIVE ARTISTS (THIS PAGE)

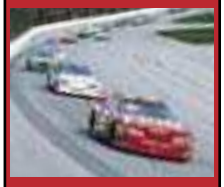
HOME

138 Homeowners Clinic
How instantaneous water heaters work. Plus, Milwaukee brandishes its big new gun: the 28-volt power drill.

PHOTOGRAPH BY DAN SAELINGER (DRILL), ANDREW HETHERINGTON (ROBOT)

WHAT'S HOT THIS MONTH ON

Popular Mechanics.com



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AUTOMOTIVE

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Tune in at **www. popularmechanics.com** the week of May 16 for race highlights at Silverstone, England, run-flat tire technology from Southern France and braking research in Bergamo, Italy—courtesy of our hosts Maserati, Pirelli and Brembo.

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LIMITED-EDITION WATCHES MARK TIMEX'S 150TH ANNIVERSARY

Timex shows that the new millennium is as exciting as the past by introducing a series of limited-edition watches called the XFactor Collection. Go to **www.popularmechanics.com/timex** for more.

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Launchpad Doubts

Discovery rolls to the launchpad, April 6, 2005.

Go or No-Go? It's the ultimate decision, the kind that faces a mountain climber poised for a summit bid or a pilot preparing to take off into sketchy weather. For NASA's engineers and astronauts, wrestling with the Go/No-Go decision is central to the culture of the space agency. And no program has been more marked by launchpad debates than that of the space shuttle.

The idea of a reusable spacecraft capable of flying home through Earth's atmosphere was elegant—despite the program's deliberately workaday name. But even before the shuttle's first mission in 1981, critics worried that the craft would prove more delicate than durable, and that maintenance expenses would quickly swamp any cost savings. The critics proved right on both counts.

Still, the shuttle program has retained public and congressional support through two tragic mission failures, and the astronaut corps has shown an inspiring determination to keep flying. Just as it prepared to return to orbit with the heavily refurbished *Discovery* (see page 110), NASA announced details of its plan to retire the shuttle by 2010. By then, work should be well under way on the next space vehicle, one that will take us back to the moon and beyond. (Lockheed Martin gives PM an advance look at its proposed vehicle on page 114.)

But what do we do until then? Keep flying the beautiful but vulnerable shuttle? Or wait until the next-generation craft is ready? PM invited two experts to weigh in. Duke University history professor Alex Roland, a longtime shuttle critic who once served as NASA historian, says, "Retire it now." "Keep it flying," counters astronaut Ken Bowersox, director of Flight Crew Operations at Johnson Space Center. PM contributor Kristin Roth interviewed both men for the project. "They actually agree on many points," she says. "But they disagree on whether the risks and cost are worth it." We hope you'll give both sides a fair hearing—then, let us know what you think.

James Meigs

CONTRIBUTORS

PM looked long and hard to find the perfect family to serve as guinea pigs in our new series, the "Digital Family." Enter Jamieson and Peggy Jones, who dove into this experiment in living with the latest high-tech gear. Contributing editor **REBECCA DAY** (above, at left) worked with the Joneses in picking the gear, and watched how it changed their lives. "I enjoyed seeing how people with different comfort levels adapted to the equipment we chose," she says.

For "Freedom Of The Road," our road trip roundup, we needed somebody to drive California's Pacific Coast Highway in one of Detroit's coolest new cars, the Mustang convertible. West Coast editor **BEN STEWART** didn't complain. "It was the best road trip I've ever taken," he says, "and I've driven coast to coast 11 times."

Writer/photographer **STEVE CASIMIRO** (at the wheel, of course) was already a veteran of Utah's back roads and backcountry when we asked him to return for our "Freedom Of The Road" package. "I like that you can see forever, but not always get there easily," says this well-traveled adventurer. "You can be alone—or lost or in trouble—without much effort at all."

PHOTOGRAPHS BY AP/WIDE WORLD PHOTOS (DISCOVERY), ALYSON ALIANO (JAMES MEIGS), ALISON ROSA (REBECCA DAY), JENNIFER ROCHOLL (BEN STEWART), STEVE CASIMIRO (HIMSELF)

Shoot For The Moon

I read your article "Playing With Fire" (April 2005), and I wanted to inform you that here at Fort Stockton High School we are building and launching high-powered rockets. We made history by being the first high-school class to successfully launch and land a rocket at a Texas spaceport, using our own design.

Steven Franco
Fort Stockton, TX

Danger Zone

Your story "Running The Gauntlet" (April 2005) made me realize there is something wrong when the U.S. government pays Blackwater contractors 10 times what it pays its own soldiers—and when these people are better equipped than the young men and women serving their country.

Jonathan Lutz
Calgary, Alberta

Thanks for the recent piece. We're all thrilled; it depicted the reality of what it is like out here. We're successful on each mission because of the posture we take to thwart any kind of attack. I'm just glad the article didn't show us as "cowboys."

Miyagi
Blackwater Mamba PSD
Via E-Mail

"Miyagi" (for security reasons, many contractors go by their radio call signs) also sent this picture (below), showing Blackwater team members catching up on their reading during a break at the Baghdad airport. According to the Brookings Institution, at least 273 contractors have been killed in Iraq to date. Ten were from Blackwater. —Ed.

Toxic Train Wreck

Based on more than 40 years' experience as an engineer with the Norfolk Southern Railway, I believe the wreck could have been avoided if cab signals [a display in the conductor's cab that shows the status of upcoming switches and speed indicators] were used on this piece of track ("Collision Course," April 2005). Only one person should have been fired for this accident—the conductor. He is responsible for proper switch alignment and reporting the track was clear.

Robin Forbes
Millerstown, PA

The railroads' safety record is very good when you consider the amount of cargo that traverses the country by rail in a given month.

Tom Winans
Lyndonville, VT

I am a locomotive engineer, and I wanted to point out some things in your switch diagram in the What Went Wrong article. First, a normal switch has reflectors that turn only 90°. In your drawing, an oncoming train would see a white target even if the switch were in the wrong position. The switch stand handle should be a lot lower, with a way to latch it, and the switch points should both be on the inside of the straight track.

William Starley Jr.
Dublin, GA

The American Pastime

Comparing Barry Bonds to Babe Ruth is an insult to the game of baseball ("Barry Vs. The Babe," April 2005). The Babe's only vices were tobacco, alcohol and loose women.

Doug Bernstein
Mooresville, NC

Clarification: In "Blackout: The Conspiracy Theory" (November 2003), PM quoted a paper by Lt. Col. Bradley K. Ashley titled "Anatomy Of Cyberterrorism: Is America Vulnerable?" Ashley was never interviewed for the story. PM regrets any confusion this may have caused.

To have a letter considered for publication, please include your full name and address, even if you correspond by e-mail. We'll withhold your identity upon request but will not print an anonymous letter. All letters are subject to editing for length, style and format.

Game Time

The century of the airplane, computer and electric toothbrush was also the golden age of new sports.

51 Years Ago (APRIL 1954)

Caddyshaft

Isn't *everything* more fun with dangerous projectiles? In archery golf, players shoot an arrow from hole to hole, and then for the final "putt," shoot a rubber ball off a pedestal. Yes, the occasional archery golf tournament still provides country clubs with extra cash flow—but only in the winter, when arrows can't damage the frozen fairways.

33 Years Ago (JUNE 1972)

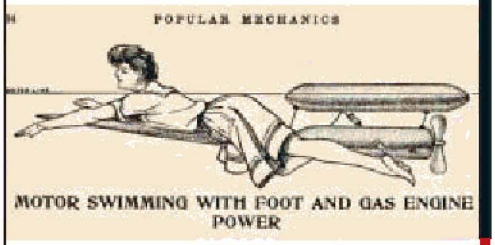
It'll Never Last

When hang gliding first got off the ground, "pilots reached altitudes of 60 ft. or more," child's play compared to today's typical altitudes of several thousand feet. PM revealed this impossible-to-follow safety tip from the pros for the "nervy new sport": Never fly higher than you're willing to fall. Bizarrely, the most dangerous and seemingly craziest sport on this page is the only one that has continued to thrive.

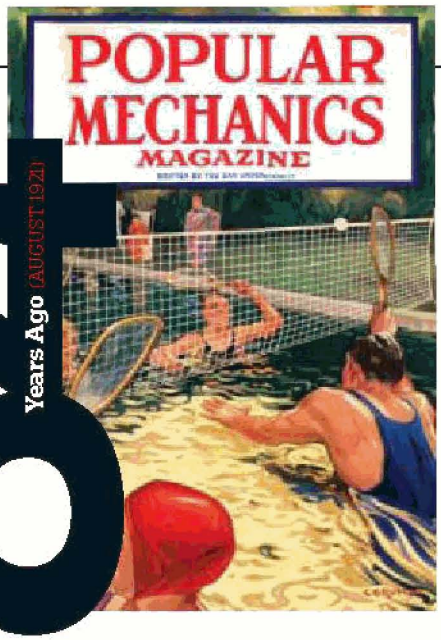
99 Years Ago (NOVEMBER 1906)

Drag Racing

Leave it to grown-up Victorians to find a way to swim fully clothed—with "motor swimming." While one model included a gasoline engine that strapped to the back, this foot-propelled type was connected to a float that supported swimmers and kept their heads above water. It was more than 5 ft. long and made of nickeled copper, aluminum and bronze, making it easy to see why we went back to regular swimming. **PM**



87 Years Ago (AUGUST 1921)



Water Tennis, Anyone?

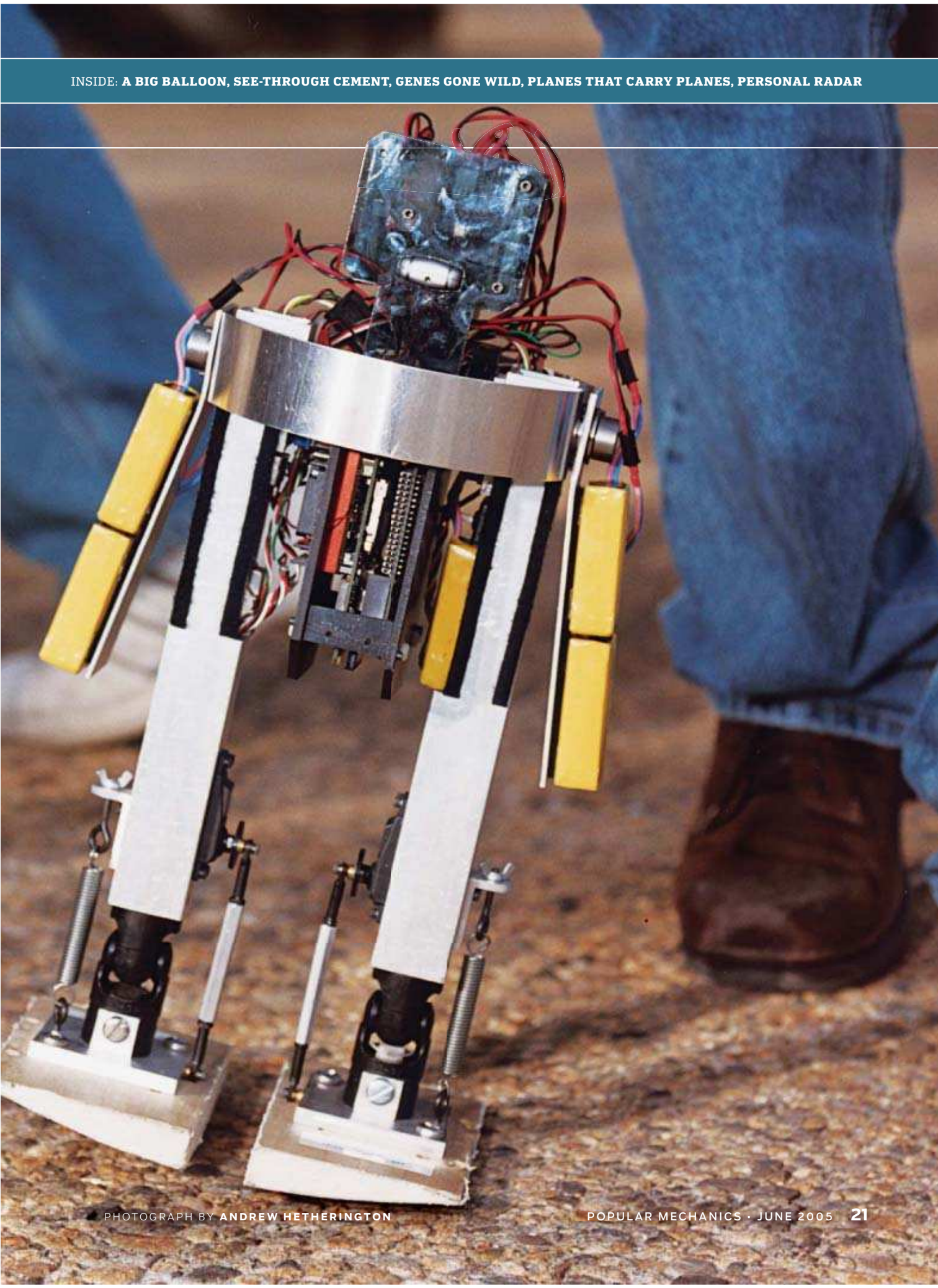
Jazz Age guests at California's Hearst Castle must have loved it. Water tennis, played in ponds or pools with a rubber ball, was sweeping the West Coast party circuit. "An occasional mouthful of water adds to the fun," PM cheerfully noted. Alas, it gradually gave up the limelight, but lives on as a physical therapy regimen for arthritis patients.

Baby Steps

Machines can disarm bombs and beat us in chess, but when it comes to walking, humans still have a leg up. Researchers at the Massachusetts Institute of Technology, Cornell University, and Delft University of Technology in the Netherlands have been working on robots that shuffle their feet with the gait, control and efficiency of human movement. Three bipedal robots have come out of the cooperative program, one from each university. The one seen here, named Toddler, was built at MIT. He uses a reinforcement learning algorithm to adapt to the given terrain, mastering each new surface within minutes. "The vision behind the program is to change the way people build walking robots," says Toddler's co-creator Russ Tedrake. "We hope to develop humanoid robots that would be suited for walking on Mars, handling toxic spills or developing new prosthetics." If Toddler continues walking nicely, Tedrake promises to set him up with a shiny pair of knees. — JENNIFER BECK

TODDLER STATISTICS
Weight: Just over 6 lb.
Height: 18 in.
Stride: 3 in.
Speed: Less than 1 mph
Motors: Two in each ankle
What's in Toddler's tummy: 700-MHz processor, 802.11b card, 256MB RAM, 2GB flash memory

INSIDE: **A BIG BALLOON, SEE-THROUGH CEMENT, GENES GONE WILD, PLANES THAT CARRY PLANES, PERSONAL RADAR**



PHOTOGRAPH BY **ANDREW HETHERINGTON**

Highest Eye In The Sky

NASA and the Swedish Space Corp. are hoping to launch a 40 million-cu.-ft. balloon by June 5. It will carry the 6000-pound Balloon-borne Large Aperture Sub-millimetre Telescope (BLAST) to the upper-atmosphere altitude of 130,000 ft., granting a clear view into space. Launching from Kiruna, Sweden, BLAST will use bolometric arrays to measure extraordinarily small amounts of radiant energy—offering a cosmological peek into the forces that form stars and galaxies. If all goes as planned, BLAST will descend six to 10 days later and land in western Canada or Alaska.

MOST CROWDED SHIPPING LANE

This year, Britain commemorates the 200th anniversary of its naval triumph over the Franco-Spanish armada at the Battle of Trafalgar. The celebration kicks off in the waters near Portsmouth in southern England on June 28 with the International Fleet Review. More than 40 nations have accepted the invite—including France and Spain.

Greatest Gizmo Show

INPEX, the Invention & New Product Exposition, billed as America's largest invention trade show, fills the Pittsburgh ExpoMart convention center June 8 to 11. Last year's show featured 1000 inventions from 18 countries. Our favorite: the Sundogger, a solar rotisserie hot dog cooker.

DIRTIEST RACE

The spirit of "Mad Max" lives on in the land down under this month in the Tattersall's Finke Desert Race. Beginning on the 11th, the town of Alice Springs will play host to this gritty two-day competition that sends cars, dune buggies and motorcycles through 300 miles of unforgiving Outback. The atmosphere of the lead-up festivities is definitely party hearty, as expressed on the race Web site: "Bourbon is the unofficial currency of the Finke Desert Race, all bribes gratefully accepted."

Longest Slab

The new 3971-ft. Victory Bridge connecting Perth Amboy and Sayreville, N.J., will honor the state's war dead from World War I—and set a new record. The 440-ft. main span will be the largest segment ever built in the United States using the precast match-cast technique, which lets builders prefabricate huge sections of bridge to precise measurements, then drop them into place on site.

BY AARON DALTON

PHOTOGRAPHS BY INTERNATIONAL FESTIVAL OF THE SEA (SHIPPING LANE), JOE MARTZ (BLAST), ERIC FRISCHE (BALLOON), MOVINGPICTURES.COM.AU (DESERT RACE)

MONSTER TRIKE

Sporting a 510-hp V8 engine, the Eliminator is the Dodge Viper of trikes. It's also the first one-off created by custom trike builders Mike Fleming and Tim Byers of Eliminator Trikes in Mesquite, Nev. The plush three-wheeler has Austrian leather upholstery and a handcrafted steel dash with a retractable LCD. Byers and Fleming will build anything a client can imagine. The cost: $100,000 and up. The reaction: priceless.

Trouble At Airbus?

The facts are simple: On March 6, 2005, Air Transat Flight 961 took off from Varadero, Cuba, bound for Quebec City with 270 passengers and crew. Twenty-three minutes later, in still air at 35,000 ft., the plane's 28-ft.-long carbon-fiber rudder disappeared. One moment it was there, the next it was gone. The pilot returned to Varadero and landed safely.

The incident was odd enough, but the Canadian charter company's Flight 961 was an Airbus A310, similar to the A300-600R that crashed just after takeoff from Kennedy Airport in New York in November 2001, killing 265. The cause: a separating vertical stabilizer.

Airbus says there are more differences than similarities between the events. Ted Lopatkiewicz, a U.S. National Transportation Safety Board spokesman, agrees. In the 2001 crash, American Airlines Flight 587 "didn't lose its rudder," he says. "Its tail fin separated and took the rudder with it, while the pilot was aggressively using the rudder."

However, pilots' Internet chat rooms are humming with speculation—such as the idea that a flaw in Airbus's composite carbon-fiber tails and rudders is causing them to delaminate. Billy Walker, an Airbus driver and airline test pilot, as well as a former pilot examiner for the A320, is unfazed. "I equate 587 with a lack of proper pilot inputs," he says. "You just don't need rudder at all in these airplanes unless you're landing in crosswinds or you lose an engine."

The Canadian Transportation Safety Board's investigation may take months. But, says the TSB's John Cottreau, "If we select an occurrence to investigate it's because we think there's a lesson to be learned."

—Carl Hoffman

News Briefs

Lifesaving Cinch

When soldiers are severely wounded, they often have to improvise a tourniquet. But a new Velcro model could make self-triage faster and easier, potentially saving limbs and lives. The Army has ordered 172,000 of these tourniquets to send to U.S. troops in Iraq.

U-Boat Traffic

In March, police in Colombia acting on a tip found a homemade fiberglass submarine designed to smuggle over 10 tons of cocaine. This is the second drug-smuggling sub discovered in Colombia. The previous one was designed to hold more than 15 times as much.

Power Porker

Hogzilla, a feral swine said to weigh a half-ton that was purportedly shot last June in Georgia, came face to face with skeptical science and emerged mostly unscathed. Experts from *National Geographic* dug up the remains of the giant hog. The verdict: Hogzilla was a boar/pig hybrid weighing around 800 pounds, but he was real.

CONTRIBUTORS:
SARAH DEEM, ALEX HUTCHINSON, CAROLYN SHEA

PHOTOGRAPHS BY RONKIMBALLSTOCK.COM (TRIKE), AP/WIDE WORLD PHOTO (HOGZILLA)

Hard Science

Concrete, metal alloys—and corn, of course—receive a high-strength makeover. BY ALEX HUTCHINSON

Translucent Concrete: The blocks shown here are concrete. And, they transmit light. Like the ordinary stuff of traffic dividers, the material is a combination of cement, sand, gravel and water, but it's embedded with glass or plastic fibers that make it translucent. It is due on the market later this year. **Function:** At five times the price of normal concrete, this material will likely be limited to use in specialty structures, such as a subway station that lets in the light.

<1

2>

Carbon Nanotubes: The smallest nanotubes, about 10,000 times thinner than the carbon fibers found in everything from bulletproof vests to high-end sailing masts, are made of a sheet of carbon that is just one atom thick, rolled up like a drinking straw. Prices start around $10,000 per ounce. **Function:** Ultralight and hundreds of times stronger than steel, nanotubes are proposed for a vast array of end uses—including an elevator to outer space.

<3

Transparent Alumina: This compound of aluminum and oxygen occurs naturally as ruby and sapphire. Researchers at 3M recently developed a new method for sintering small alumina particles together to form colored bulk glass. **Function:** Several times harder than conventional silica-based glass, alumina can be made into shatterproof windows.

Fiber-Reinforced Polymers (FRPs)

Small fibers of carbon or glass are embedded in plastic to make a strong yet flexible composite. **Function:** In use since the '60s, FRPs are now a cheap, corrosion-free concrete reinforcement material. Replacement FRP-based bridge decks can be prefabricated, reducing closure times.

4^

<5

Sorona: DuPont's first new polymer in 20 years, Sorona can be woven to make fabrics or molded into solid resins for uses such as packaging. Starting next year, it will be made out of corn sugars, making it both fashionable and eco-friendly. **Function:** It should do everything that nylon does. DuPont says it's softer, easier to dye and stain resistant. Best of all, it's made from a cheap, renewable resource.

Fries With That Ferrari?

Fast-food restaurants are testing an artificial intelligence system that predicts what customers will order based on the make of car they drive. The system, from HyperActive Technologies, monitors traffic flow in the parking lot and drive-through with rooftop cameras, helping staff stay a few burgers ahead of the rush.

Gene Mystery

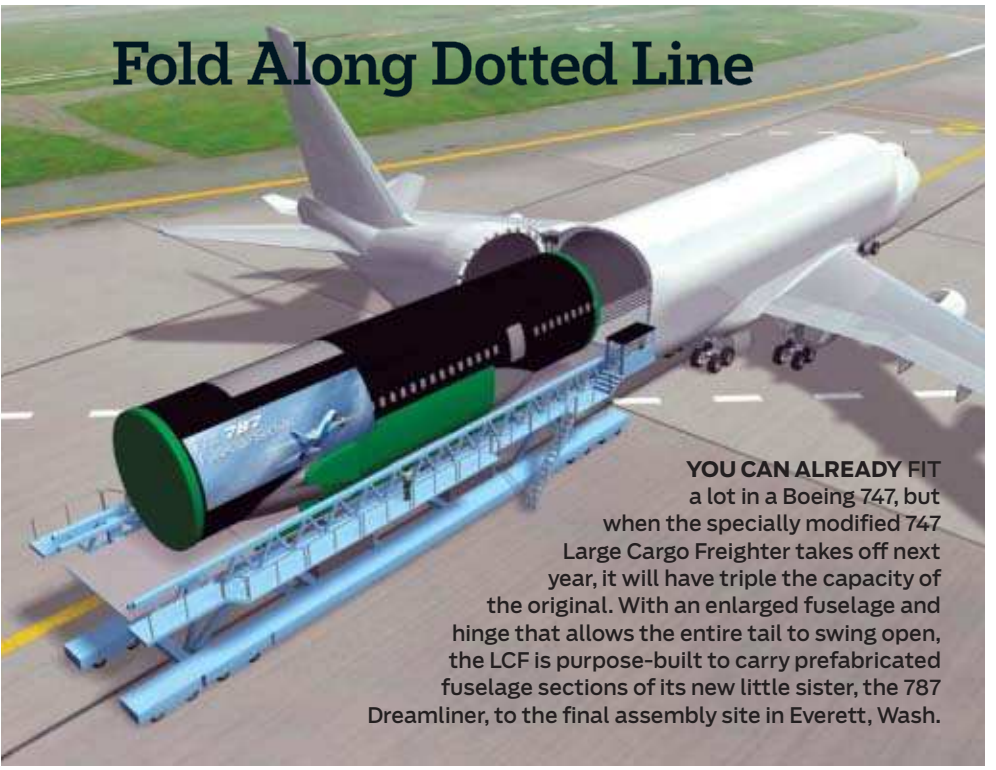
Gregor Mendel must be spinning in his grave. Geneticists at Purdue University studying the *Arabidopsis* (above) found plants that had a normal version of a gene that was defective in its parents. That's not supposed to be possible. The source of the "healthy" DNA is unknown, but researchers wonder if a never-noticed genomic backup made of RNA could be lurking within the plants' cells.

Hamburglars

As if raiding jewelry boxes weren't enough, thieves often pause to raid the fridge before making a getaway. Recently, researchers at the National University in California studied which half-eaten foods are best at preserving valuable traces of DNA evidence to help nail those freeloaders. The results: Leave cheese and carrots out, but hide the chocolate.

PHOTOGRAPHS BY LITRACON GMBH (CONCRETE), JERRY O'CONNOR (FRP), PURDUE AGRICULTURAL COMMUNICATIONS/TOM CAMPBELL (PLANT)

Fold Along Dotted Line



YOU CAN ALREADY FIT a lot in a Boeing 747, but when the specially modified 747 Large Cargo Freighter takes off next year, it will have triple the capacity of the original. With an enlarged fuselage and hinge that allows the entire tail to swing open, the LCF is purpose-built to carry prefabricated fuselage sections of its new little sister, the 787 Dreamliner, to the final assembly site in Everett, Wash.

OUT OF THEIR ELEMENT

After 70 rough-toothed dolphins—normally deep-ocean denizens—mysteriously beached themselves in Marathon, Fla., we asked cetologist Kenneth C. Balcomb III, head of the Center for Whale Research in Friday Harbor, Wash., to list the leading explanations for the rising number of marine mammal strandings.

The Theories

1. Diseases caused by such organisms as Morbillivirus—a virus related to distemper in dogs and measles in humans, and possibly linked to contaminants in body tissues. Toxins from algal blooms, or red tides, have also been implicated.

2. Navigational errors due to faulty echolocation or misread magnetic clues. This is especially significant in places where natural shoreline traps exist, like Cape Cod, Mass., and Hawke's Bay, New Zealand, which have both seen repeated stranding episodes.

3. Powerful acoustic disturbances such as underwater seismic events, the active sonar increasingly used in naval operations, and activities (from sonar to drilling and blasting) associated with gas and oil exploration. Some research suggests that frequencies used in military sonar can force nitrogen in the animals' flesh to form bubbles, leading to internal injuries similar to those caused by "the bends" in scuba divers.

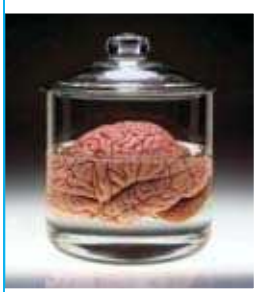
Jurassic Parts

The fossilized, recently unearthed bones of a Tyrannosaurus rex contain 70-million-year-old soft tissue that resembles blood vessels and cells, raising the possibility of extracting dinosaur DNA. Archeologists in Montana found the tissue in the core of a 3.5-ft.-long thighbone after accidentally breaking it while loading it into a helicopter rig.

(Tiny) Black Hole

Scientists speculate that a fireball created by smashing particles together with the Relativistic Heavy Ion Collider at Brookhaven National Lab in Upton, N.Y., behaved like a black hole, absorbing particles and hitting a temperature 300 million times hotter than the sun's surface. The fireball was powerful, but (fortunately) brief—lasting about a trillionth of a trillionth of a second.

Jarhead Pilot

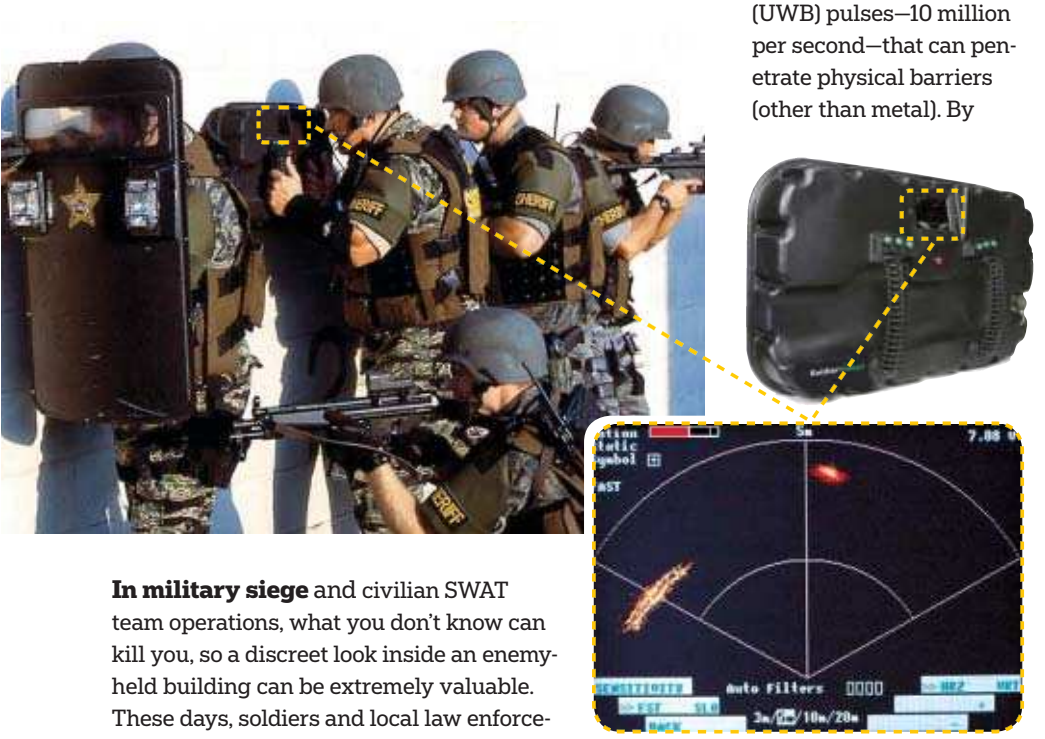


Researchers at the University of Florida have created a "brain" in a dish that can fly an F/A-22 jet simulator. A "living computer" constructed of 25,000 rat neurons was linked to the flying program by an array of electrodes that passes information and instructions back and forth. By adapting to feedback pulses from the simulator, the brain has learned to control the virtual jet in a variety of weather conditions.

ILLUSTRATION BY BOEING (PLANE), PHOTOGRAPHS BY AP/WIDE WORLD PHOTO (DOLPHIN), CORBIS (BRAIN)

Seeing Through Walls

New technology makes it possible to look inside an enemy hide-out before busting down the door. BY FRANK VIZARD



In military siege and civilian SWAT team operations, what you don't know can kill you, so a discreet look inside an enemy-held building can be extremely valuable. These days, soldiers and local law enforcement are discovering that the X-ray-vision fantasy of comic books is a technological reality.

Through-the-wall (TTW), radar-based surveillance technology has been aggressively researched by military and university labs since the mid-1990s, and now two technologies are making their way into the market. Two years ago, the first commercially available, portable TTW product was launched by Time Domain, a small Huntsville, Ala., company working with funding from the Air Force Research Lab (AFRL). And, a more advanced system is in development in a joint project between Raytheon and the National Institute of Justice.

Time Domain offers two handheld TTW radar systems. One is called SoldierVision A1, while the other is a slightly less powerful version for police called RadarVision 2. This technology doesn't come cheap. Each SoldierVision A1 unit costs $29,500 and RadarVision costs $32,000.

Unlike standard radar that emits long sine waves that bounce off objects, SoldierVision A1 emits a massive amount of short ultra-wideband (UWB) pulses—10 million per second—that can penetrate physical barriers (other than metal). By analyzing the return signature, SoldierVision A1 can detect movement by bad guys on the other side of a wall, using less power than a cellphone.

The 10-pound, handheld SoldierVision A1 can see through wood, brick, gypsum and concrete.

SoldierVision A1 can be used at a standoff distance of 30 ft., while detecting motion 30 ft. beyond the other side of a wall. Placed flat against a wall, SoldierVision A1 can sense movement within a 180° range. That motion is displayed as a moving blob viewed from a top-down vantage point on a small screen built into the unit.

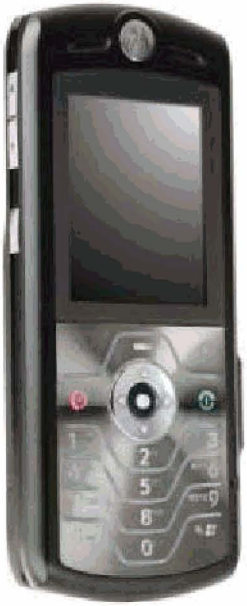
SoldierVision A1 is not without its limitations. It's hardly pocket-size, and it displays individuals clustered together as a single blob on the screen. Defense contractor Raytheon is developing a low-cost Enhanced Motion and Ranging System (EMARS) that weighs less than 3 pounds and can be held in one hand. Three EMARS units can be used to triangulate received radar signals for a better picture of how many people are behind a wall. This data can be wirelessly transmitted to a laptop up to 300 ft. away.

Both EMARS and SoldierVision A1 can do more than see through walls. UWB, for instance, shows promise as a covert data transmission technology and can be adapted for tracking and perimeter security. What's more, it could potentially be used in avalanche search-and-rescue operations.

"EMARS and UWB are the ones we're pursuing now," confirms AFRL program manager Bernard Clarke. Think of it as X-ray vision for regular guys. PM

The Fish Finder

The first Inuit kayaks were designed to hold gear, move efficiently through the water, and help their owners find a lot of seals. The Hobie Mirage Sport Fisherman ($1399) probably won't be seen bouncing off icebergs, but it is exceptionally well designed to help modern-day fishermen land their quarry. This 9-ft.-7-in., 52-pound boat has plenty of storage for bait, tackle and gear. You'll also find molded-in rod holders and even a mount for an optional sail. Plus, this kayak has Hobie's innovative MirageDrive pedal system, which lets you slowly propel the kayak with your feet while your hands reel in the catch of the day.



Who You Callin' Pretty?

Sure, your phone's got Bluetooth, a camera and high-speed data capabilities, but that's no excuse for it looking like plasticky junk. Now, after a few years of ugliness, phone firms are getting into a design groove, with Motorola out in front. First came the sleek RAZR V3. Up next will be the sharp-looking 3.4-ounce SLVR V8 "candy bar" phone (left) and the PEBL V6 dual-hinged flip phone. Both have lots of high-tech functionality. They just happen to look good, too. Pricing is not yet available. www.motorola.com

Hip To Be Square

It's tough to innovate when building a woodworking square, which is basically a right angle made of metal. But the makers of the M-Power M3 Square take it to another level. The double-winged tool allows you to mark width and thickness simultaneously. Built in are a thumbscrew-lockdown marking gauge and a locking bevel gauge to transfer preset angles, making complex jobs a whole lot simpler. Euclid never had it so easy. **$40;** www.leevalley.com

Knife Fight

In the left corner: America's heavyweight multitool champ.

With titanium-cast, redesigned handles, the **Leatherman Charge Ti** weighs in at $124.

FORM

It's as boxy as a vintage Volvo, but only half as pretty. Judges mistook it for a toaster.
Score: 9 points

EVO's curves fit as easily in well-tailored Carhartts as in a manicured hand.
Score: 10 points ▶

WEIGHT

They got it backward: The *word* titanium is supposed to be weighty, not the material. 8.4 oz.
Score: 8 points

EVO's clearly been skipping the fondue. Floats like a butterfly at 3.2 oz.
Score: 10 points ▶

FEATURES

Two knife blades—one's serrated—interchangeable driver bits and iron-jawed pliers. Take that, Swiss Miss!
◀ **Score:** 10 points

All the Alpine essentials—bottle opener, nail file, scissors, toothpick and tweezers—save one. Where's the corkscrew?
Score: 8 points

FUNCTION

Pliers closed, it's a ninja-fast, one-handed locking blade. Open, a portable toolkit. A one-two combo.
◀ **Score:** 10 points

Marshmallows beware! Small twigs stand no chance against EVO's sharp-toothed saw blade.
Score: 8 points

WINNER

Leatherman Charge Ti, by unanimous decision.
It's a little heavy, but we prefer Leatherman's "A-Team" approach to Swiss Army's "MacGyver." We'll save the EVO for the Gruyère.

In the right corner: The closest thing Switzerland has to a strategic arsenal.

Welterweight $49 **Wenger EVO 18** is a high-finesse knife in the Swiss Army tradition.

PHOTOGRAPHS BY BURCU AVSAR (M3 SQUARE), DAN SAELINGER (LEATHERMA

Monster Sieve

The Short D-Handle Round Point Perforated Shovel from Gempler's may seem like a joke item at first (one with an oddly long name), but its utility lies in its ability to separate large debris from silty water and soil. The shovel can help you clean an irrigation ditch, segregate stones from sand, or, well, pan for really big nuggets of gold. Its tempered-steel blade will lift 270 pounds and its fiberglass handle won't crack under heavy loads. Finally, a tool for the discriminating shoveler. **$60;** www.gemplers.com

Chilling Out

Those long, lazy summer drives are a great way to unwind—that is, until you find yourself sticking to the seat in a most ungraceful manner. The Norcord SummerSeat can help. The portable cooler uses an adjustable, built-in fan to pull the hot air away from your back and legs. It has a 12-volt car plug and AC connector, just in case you find yourself in the hot seat at home, too. **$60;** www.wwtgroup.com

Ground-Based Surveillance

When you look into a crystal ball, you normally see the future, but what this silver sphere reveals is the present. Sony Ericsson's ROB-1 is a 4.3-in.-dia. rolling camera that broadcasts to a mobile phone using Bluetooth wireless technology. ROB-1 can be operated at a distance of 150 ft. or more by means of the keypad or joystick on the user's phone. It streams video as it rolls around and can pivot on a dime. The camera can rotate up and down. The ROB-1 should cost about $250 when it is introduced late this summer. www.sonyericsson.com

PHOTOGRAPH BY DAN SAELINGER (SHOVEL)

Road Show

No, it's not a new Billy Bob Thornton flick. The Slingbox redirects video from your digital video recorder, cable or satellite system to any computer on Earth that has broadband Internet access. It's a remarkable advance. Just remember: When the boss asks, you need that laptop along to do business on the road. **$249;** www.slingmedia.com

Cool Hand Luke

Gamers, picture this: You're steering a Subaru Impreza WRX STi into a hairpin curve in Gran Turismo 4 when the controller slips from your clammy palms. Nyko Air Flo controllers ward off such disasters with fans that dry your hands. Available for most gaming systems. $20 to $40; www.nyko.com/airflo

The Layabout

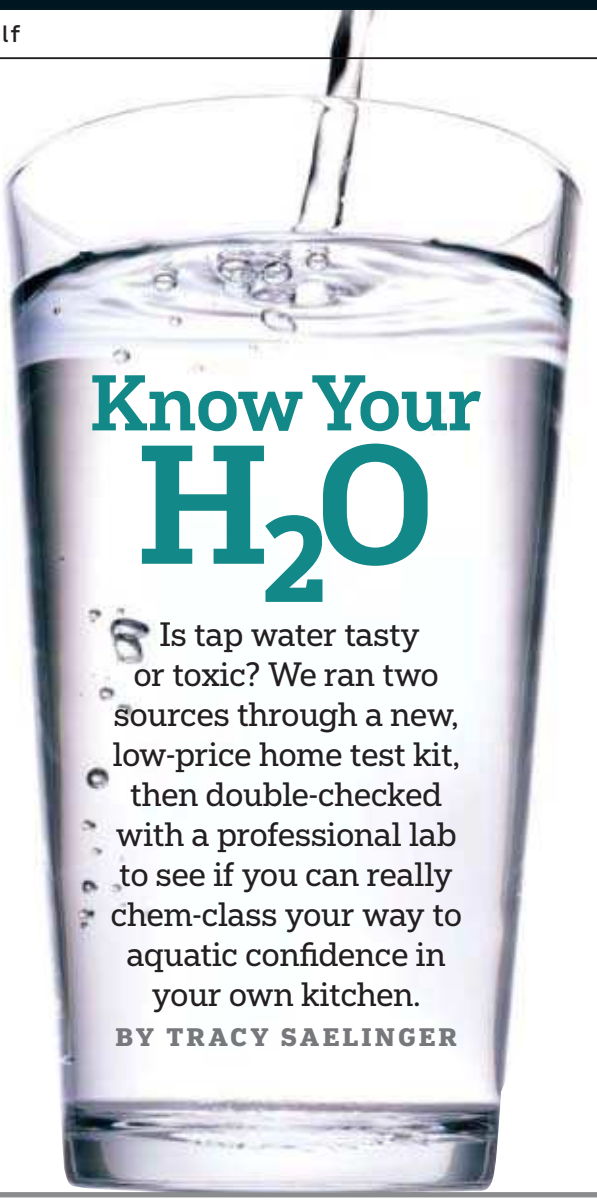
This summer, Americans will be relaxing in all manner of collapsible, foldable, sling-over-your-shoulder seating. But you can outrelax them all with the Kelsyus portable backpack hammock. It has a strong, folding steel frame that weighs (oof!) about 22 pounds but sets up hassle-free in minutes. Lemonade and book not included. **$100;** www.swimways.com/kelsyus/

MP3 Express

Who has time to rip music files? These services will convert your entire CD collection into a pristine, portable music library—filling up your iPod in one fell swoop.

	RipDigital	ReadyToPlay	MusicShifter	PacificRip
Cost of 100 CDs	$129	$110	$89	$125
Cost of 200 CDs	$199	$220	$178	$230
Cost of 500 CDs	$499	$517	$445	$495
Fill a 40GB iPod	$399	$418	$356	$396
Turnaround (minus shipping)	7 to 10 days	Less than 2 days	5 to 7 days	3 days
Extras	Perhaps the biggest and best known of these services.	Very accommodating. Will load files onto hard drives and music players.	Most flexible with file formats. And, you get a free trial order of 25 CDs.	Detailed listing of artist, album and song titles is a big help for managing tracks.

PHOTOGRAPH BY MICHAEL WILDSMITH/GETTY IMAGES (CD STACKS)



Know Your H_2O

Is tap water tasty or toxic? We ran two sources through a new, low-price home test kit, then double-checked with a professional lab to see if you can really chem-class your way to aquatic confidence in your own kitchen.

BY TRACY SAELINGER

HOME KIT

We analyzed tap water from a big-city municipal water supply and well water from a house next to a horse farm. Results from the home kit were similar to the lab findings on most tests, but the kit's test strips—two with pass/fail lines and two with a spectrum of colored reagent pads—involved some guesswork (is that dark purple gray or just purple gray?). And pass/fail, while okay for junior high gym, is a bit dissatisfying when checking for, say, lead.

HOME TEST RESULTS

	CITY	WELL
pH	7.5	7.5
hardness	0	120*
chlorine	0	0
nitrate	0.5 *	2.0*
nitrite	0	0
lead	neg.	neg.
pesticides	neg.	neg.
bacteria	neg.	neg.

* parts per million

THE LAB

There's something about numbers down to the ten-thousandth decimal place that brings peace of mind. Plus, labs are less work: Fill a few bottles, send them off, and results are back in a week. And, the lab can talk you through the findings. The prices hurt the stomach as much as giardiasis, but you can skip the more esoteric tests to keep costs down. Bottom line: Well owners should test yearly with a home kit. If anything raises eyebrows, go to the lab.

LAB TEST RESULTS

	CITY	WELL
pH	6.7	6.7
hardness	20*	84*
chlorine	0	0
nitrate	0.23*	1.9*
nitrite	0	0
lead	0	0
pesticides	0	0
bacteria	0	0

* parts per million

THE KIT
Silver Lake Research Watersafe test kits ($17; www.watersafekits.com). Available in grocery stores.

THE LAB
Premier Laboratory ($230; www.premierlaboratory.com). Choose a state-certified, EPA-approved lab.

The Fetid Spectrum

After trying it at home, we took our kit on the road to test the potability of the wide world of wet.

GOWANUS CANAL, N.Y.
Notorious toxic waste site.

Bacteria, off-the-scale hardness and plenty o' pesticides.

DUCK POND
Lots of ducks. Lots of bread.

Positive for nitrates and bacteria—and that was on a cold day.

REST STOP SPIGOT
Infamous for EPA violations.

A bit hard, but it won't kill you—if you don't mind the iron-mine taste.

LIGHT BEER
Like water, but less flavorful.

Sure it has bacteria, but it's the good kind, like in yogurt.

BOTTLED WATER
You just never know.

The water we tried was pricey—but otherwise darn near perfect.

DRINKABILITY INDEX

Summer Essentials

Here's the gear you need to get the most out of the beaches, campgrounds and backyard pools of America.

1

2

3

4

Victoria Polyvac Skimboard
Constructed of an aerospace polyvinyl-foam core and a tough, scratch-resistant resin shell, the Polyvac is an ideal board for skimming the shoreline. **$350;** *www.victoriaskimboards.com*

1 Coleman Ultimate Xtreme 50-Quart Wheeled Cooler
This ultra-insulated food and drink caddy can store ice in 90° heat for up to six days. **$50;** *www.coleman.com*

2 Sony PlayStation Portable
A superb handheld gaming station with an astounding screen and beautiful graphics. Plus, it has a Wi-Fi link and plays movies. **$250;** *www.us.playstation.com*

3 Rainbow Reef Battle Shark
Sure to raise a few dorsal fins this summer, these toothsome battery-operated fish have flexible tails and swim around your pool with lifelike menace to put a little more spunk in everybody's stroke. **$20;** *www.swimways.com*

4 XACT Stream Jockey Deluxe Portable Boombox
This portable music system has Sirius satellite radio on one side, and swivels around to play CDs. It can run off AC power or a handful of D batteries. **$160;** *www.sirius.com*

SUMMER SUNGLASS GUIDE

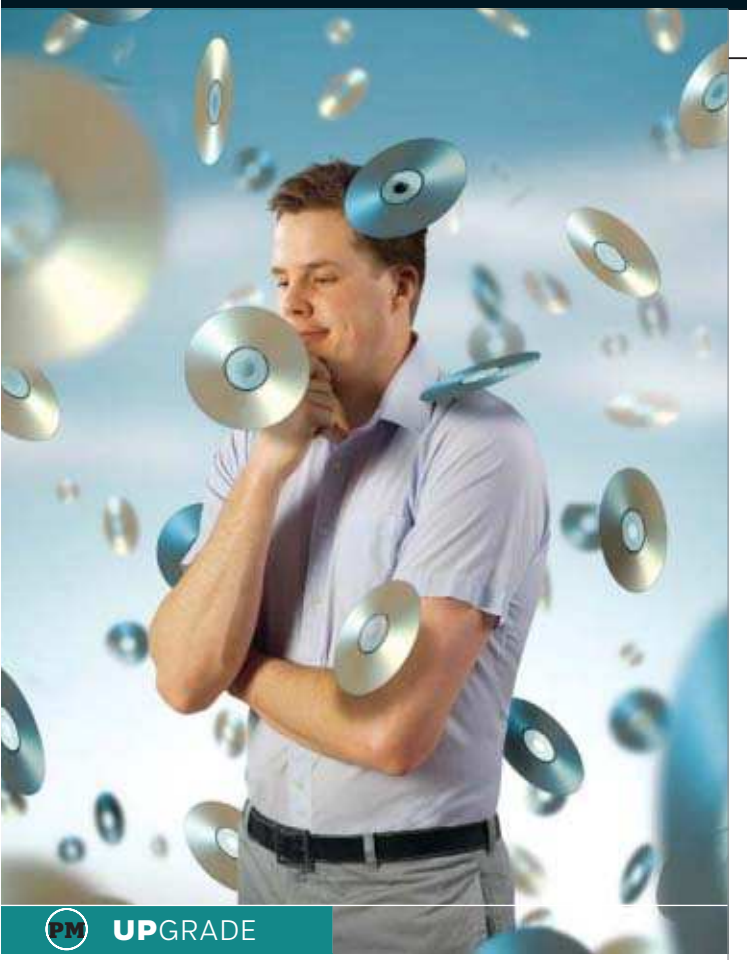
THE POLARIZER
Serengeti's PolarMax Nuvolas give you polarization in a lightweight polycarbonate lens and a sleek, modern shape. $160

THE TECHNO-FUTURIST
Oakley's RAZRWire sunglasses have a built-in Bluetooth earset. Available midsummer, price not yet announced.

THE CLASSICIST
Smith Optics Method shades have special curved, antidistortion Carbonic lenses, and a heaping tablespoonful of cool. $70

THE SPORTSMAN
Bollé Mongrels protect your eyes and hold onto your face with Thermogrip temple tips. Plus, lenses are color-swappable. $100

PHOTOGRAPH BY LUCAS VISSER (SHARK)



PM UPGRADE

New Face For DVD

High definition is coming to your DVD player soon. Deciding which of two rival formats to buy might take longer. BY JOEL JOHNSON

Clearly, the era of high-definition television (HDTV) is upon us. But buying one of these beautiful new displays is only half the equation—you need high-definition content to take advantage of the greater detail that the technology provides. In the next year, two video disc standards, HD-DVD and Blu-ray, are headed your way, each competing to become the format that will replace DVD and rule your living room for the next decade or more. Which will prevail and which will become Betamax? It's too early to tell—and that's not good news for anyone hoping to buy an HD player anytime soon. So consider this an advance scouting report rather than a mandate to pull out your wallet.

In 1997, DVDs brought digital video content into our homes by compressing high-quality video on an optical disc that holds about 9GB of information. Each frame of film is stored as a compressed digital image, sort of like a JPEG graphic, with a resolution of 720 pixels horizontally and 480 pixels vertically. That's not bad—until you compare it to HDTV, which is capable of 1920 x 1080 pixels per frame, or six times the resolution. Great—if you can find a digital video disc format large enough to store that much data.

While HD-DVD and Blu-ray standards have their own sets of advantages and disadvantages, both provide the data storage capacity and the resulting high resolution necessary to show off our high-end televisions.

Why the competing technologies? Simple: The huge revenues expected from licensing. Philips, which developed the CD almost 30 years ago, still gets 0.02 cents from each album sold on the format. Whichever company—or group of companies—ends up providing the technology to power the future of home entertainment stands to make a lot of cash. And almost as soon as the DVD hit the scene, large consortia began working on the technologies that would eventually become HD-DVD and Blu-ray.

The HD-DVD standard was developed by the DVD Forum, a group of entertainment and electronics companies, including NEC, Sanyo Electric and Toshiba, that helped create the DVD standard. HD-DVDs can store about 30GB of digital information—not quite enough to hold an HD movie encoded in MPEG2, the compression standard used in DVDs. But, this won't be a problem because HD-DVD supports new compression algorithms that allow it to squeeze more digital information into a smaller amount of disc space. An HD-DVD disc has plenty of room for HD content, with space left over for DVD-style extras such as interviews with a cast and crew.

The HD-DVD consortium has a significant advantage over the competition: It's fairly easy to convert facilities that manufacture standard DVDs into ones that pump out HD-DVDs, easing the transition for the companies that press movie discs.

What does Blu-ray, HD-DVD's competitor, offer? For starters, Sony is one of its major backers. The Japanese behemoth not only commands a

PHOTO ILLUSTRATION BY C.J. BURTON

huge electronics arm, it also enjoys exclusive access to movies and music produced under its umbrella. The Blu-ray standard is almost guaranteed to have some content that the HD-DVD will not—at least until one of the formats wins out. In the immediate future, if you want to see a Sony movie in HD, you'll have to buy it on Blu-ray.

But that's not all Blu-ray brings to the table. Technologically, the disc is superior, using a double-layer technique that compresses almost 50GB of information onto a disc the same size as an HD-DVD. That leaves plenty of room for today's material, with an added bonus: space to accommodate video at a higher resolution than HDTV currently supports. On the downside—and it's a major drawback—this technology requires all-new manufacturing equipment, meaning a greater initial investment for disc makers. The additional costs presumably will be passed on to the consumer.

Both HD-DVD and Blu-ray video players should be on the market by the end of this year (Blu-ray recorders are already available in Japan for $1900 to $2700), along with the first wave of movie titles to watch on the shiny set-top boxes. HD-DVD will probably make its way into stores a couple of months ahead of Blu-ray. On the other hand, Blu-ray has broader overall entertainment industry backing and will likely ship with a greater selection of movie titles—though, as noted above, at higher prices.

What would I buy? The wisest course is to wait for the dust to settle before putting your money into either kind of system. Of course, wisdom doesn't always win out. If you absolutely can't wait, you can take your chances with either of the systems when they come out and be the first on your block to play video discs in lifelike high-def quality. If you're willing to delay gratification a bit longer, a more economical choice will be available when Sony launches its PlayStation 3 gaming console, expected sometime in late 2005 or early 2006. It will support Blu-ray movie playback out of the box. (Then, if there's HD-DVD content you want to watch and you just can't hold off, you'll

HOW THEY STACK UP

Blu-ray	HD-DVD
DATA STORAGE	
Double-layer technique holds almost twice as much data as HD-DVDs. More room for extras and future features.	Holds about 30GB of digital information. Much less capacity than Blu-ray. Not much room for future growth.
PRODUCTION	
Requires a retooling of production lines. Upgrade costs might be passed on to consumers.	DVDs and HD-DVDs can be made on the same production line. That might mean cheaper movie discs.
AVAILABILITY	
Can't wait for the release? Players are already on the market in Japan.	Will probably be in U.S. stores before Blu-ray for the earliest adopters.
INDUSTRY SUPPORT	
Sony is a major backer, but the club also includes Dell, LG Electronics, Philips and Thomson.	Manufacturers include Toshiba, Sanyo Electric and Microsoft—which means millions of compatible computers.
MOVIE INDUSTRY SUPPORT	
More movie and music content providers, including Sony Pictures, Walt Disney and 20th Century Fox.	Pulling its own weight with New Line Cinema, Paramount, Time Warner, Universal and Viacom support.

have to buy an HD-DVD player as well. That's half the fun of being an early adopter: You get to buy twice as many toys.)

But what I'm hoping for is the best of both worlds: a hybrid machine. Yes, it's certainly possible that either HD-DVD or Blu-ray will win out over the next nine months, with the other technology bowing out gracefully. But that result seems increasingly unlikely, given the tremendous monetary stakes. Eventually, someone will make a hybrid player that supports both formats. And that's the one to look out for. **PM**

British Tailoring

You don't need an O.B.E. to drive this rolling sex pistol, just money. Lots of money.

BY DON CHAIKIN

There's a good reason TV's Magnum drove a Ferrari and the Duke boys tore through Hazzard County in a Dodge Charger. Certain cars simply exude the essence of the person—fictional or otherwise—behind the wheel. And that is why Aston Martin is so indelibly linked to everyone's favorite double-naught spy, James Bond. Aston's DB9 is the rolling embodiment of grace, good looks and suave British charm, all wrapped around more machismo than you'll find in a WWE caged-ring match.

Living the Aston lifestyle, we drove a DB9 Coupe from the ultraswank W Hotel in San Diego to lunch at an oasis in Borrego Springs. The car's intimate cockpit coddled us in leather and wool. When we tired of the 950-watt Linn audio system, we lowered the Coupe's windows and listened to the equally sweet song of the 450-hp V12 playing through the dual exhausts. Trust us,

ASTON MARTIN DB9

PRICE RANGE:
$155,000 to $175,000

the car is capable of going much faster than sane, truly competent drivers are willing to drive. The DB9 was rock solid and ridiculously proficient on the serpentine mountain roads between the Pacific Ocean and the Salton Sea. On empty, straight-line blacktop, it's a freight train.

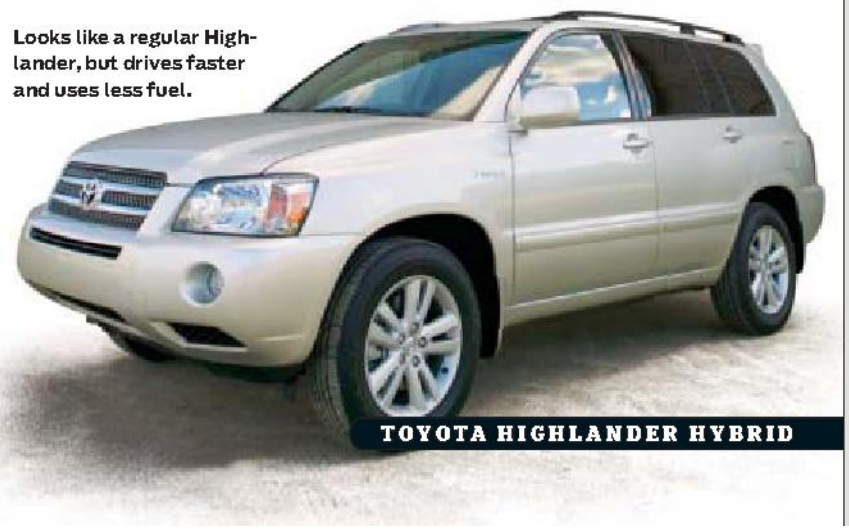
Aston Martins are largely hand-built. Since no car is begun before it is ordered, Aston can afford this luxury. So can the typical buyer. But surprisingly, the power windows do not have a one-touch-to-close feature and the glove compartment door flops open. Happily, the thick leather dulls the sting when it hits your knees.

They're Breeding

When Toyota's Lexus division launched the RX 400h in April, it, along with Ford's Escape Hybrid, broadcast to the world: You can have a politically correct SUV. And as we discovered in the hills above Santa Barbara, Calif., we can have fun while driving a hybrid. That's where we sampled the latest in Toyota's growing family of flower-friendly vehicles, the 2006 Highlander Hybrid. On the outside it's identical to the standard Highlander seven-seat SUV. With a towing capacity of 3500 pounds, the Highlander is available with either two- or four-wheel drive. It all works transparently, powered by a 3.3-liter V6 that produces 208 hp. But that's where the resemblance stops. Lurking under the Hybrid's second seat is a 288-volt battery pack that powers up to three AC electric motors, providing an extra 60 hp of short-term boost. We can attest that this brings passing ability on a par with a V8-powered SUV. At the same time, the electrically driven accessories have so little parasitic drain and the regenerative braking recycles energy so efficiently that the fuel economy is better than that of the average automotive malcontent's econocar. — MIKE ALLEN

OFF-ROAD ELECTRICITY

A separate electric motor powers the rear wheels for an unconventional but effective awd.



Looks like a regular Highlander, but drives faster and uses less fuel.

TOYOTA HIGHLANDER HYBRID

SPY REPORT

DETROIT BY JIM DUNNE

Tracking On New Wheels

No, not a crew cab F-150, but the next Explorer Sport Trac.

Ford is planning a major update for the Explorer Sport Trac. This 2006 prototype, seen in its camouflage cover-up, is appreciably larger than the current model. That's because the Sport Trac of the future will be built on the same platform as the Explorer. Until now, despite its name, the Explorer Sport Trac shared its chassis and drivetrains with the Ranger compact pickup truck. Many of the Explorer's current features will be adopted for the new vehicle, including both V8 and V6 engines, five-speed automatic transmission and a much larger passenger cabin. The new model's styling changes feature larger wheel-well flares, a taller cargo box, pull-type door handles, heavy-duty roof rack, and wheel options that are larger and wider.

Swan Song For An Ugly Duckling

We won't have the Pontiac Aztek to kick around any longer. The top brass at GM has been taking a hard look at which vehicles aren't selling well and letting them go to the big scrapyard in the sky. Pontiac's controversial Aztek is the latest in a growing list of vehicles that General Motors will ashcan this year. Gone are old and familiar names like Bonneville, Grand Am, Blazer, Jimmy and Astro, as well as the Envoy XUV and its partially retractable roof. Don't forget Saturn L, Safari and Chevy Classic, slow sellers all. Despite the cuts, GM's lineup continues to grow. New models include variants with suffixes like SS, V and Alpha on their names. On balance, GM gains more models than it discontinues.

A-OK

After driving Audi's new A4 through Arizona's Superstition Mountains and desert, we have to tip our hat to Audi's engineers. Both the sedan and wagon versions of the car handle pretty darn much identically. Trust us, that's no mean feat. And we can tell you, after our test drive, that they both handle quite well. The A4 continues the company's rush to be the premier provider of sporty all-wheel-drive cars. There's a new chassis, a new look and two new direct-injection gasoline engines: a turbocharged 2.0-liter inline Four (Audi's first direct-injected turbo engine) and a normally aspirated 3.2-liter V6. Coupled to a six-speed automatic, the car can get to 60 mph in 6.6 seconds. The Four can be mated with a six-speed manual or the automatic. Both wagon and sedan are available now. But we're really looking forward to the V8-powered S4, which should be here soon. — M.A.

AUDI A4

A4's new engines inject gas right into the combustion chamber.

Alpha Male

Hummer is introducing the ultramacho H1 Alpha, which replaces the H1 at the top of the Hummer pile with more power and a new transmission. The revised drivetrain is a 6.6-liter turbocharged V8 diesel with 300 hp and an Allison five-speed transmission. Because of the new engine's deeper crankcase, Hummer designers were forced to raise the Alpha's body 2 in. for ground clearance, making passenger entry/egress noticeably more difficult. Two body styles, the four-seat Open Top and Wagon, are continued. We got to push both Alpha versions through the rough Nevada terrain. Suffice to say, nothing stopped them. — JIM DUNNE

HUMMER H1 ALPHA

Believe it or not, the new Hummer has even more ground clearance.

SPY REPORT

On A Limb

GM wants in on the small-luxury-crossover market with this prototype.

We're going to guess this small SUV will initially carry a Cadillac crest in its grille since we can't see where else in GM's lineup it might fit. This view is an artist's enhanced copy of a photo taken in a very secret location—we don't want GM to know that we know their test drivers' haunts. But clearly, this is a compact four-door, five-passenger SUV that appears to be based on a front-wheel-drive platform, much like Ford's Escape. That flat-back shape and wraparound rear window take us back to the Chevrolet Nomads of the 1950s and lead us to believe this vehicle eventually will be offered as a Chevy, sometime after the Cadillac introduction.

Taking Aim

This tester seen near Detroit means one thing: The Caliber's coming.

Dodge unveiled its Caliber concept vehicle earlier this year at the Geneva International Auto Show. At the time, DaimlerChrysler executives were firm in labeling the vehicle a concept only. There were no promises made about production. Well, with some old-fashioned detective work and a keen eye, we have found rolling proof that the vehicle really is in Dodge's plans. Our moles inside the company tell us that the Caliber will be based on a Mitsubishi Lancer front-drive chassis. That makes sense since the vehicle will be the replacement for the Neon. Further down the road, after Caliber is launched, Chrysler will build two other versions of the vehicle, one with the Chrysler nameplate, one with the Jeep brand.

MERCEDES-BENZ M-CLASS

Tough looks, larger size and added power should make the formerly genteel M-Class more than macho enough for the SUV world.

Star Power

There was a time when the three-point star on the front of a vehicle all but ensured that vehicle's success. That era has passed. Mercedes-Benz, like other manufacturers, has to claw for sales in a competitive marketplace. And few markets are as ruthlessly competitive as that of the luxury crossover SUV. Enter the second-generation Mercedes M-Class. The more muscular 2006 M elbows its way into the crowded bazaar with a Swabian interpretation of American macho SUV styling. It has a swept-back front end and snarly fender flares. Critically, it also boasts an extra 3.7 in. of wheelbase and has more power than the outgoing model.

Putting the new M-Class through its paces in the South of France, we found the V8 swooped along the autoroute from the Mediterranean into the rumpled interior of Provence without breaking a sweat, its unique seven-speed automatic transmission smoothly micromanaging gear changes. The double-wishbone front suspension tamped down road noise into the funereal range. Off the French version of the interstate, the M-Class's suspension setting dramatically reduced dip and sway on twisting country roads. We can attest that the optional Off-Road Pro engineering package is effective and makes taking this extremely capable vehicle off pavement virtually idiotproof. Waddling through cratered tracks, wading down a mountain stream, clambering up steep banks—the suspension grunts and groans to boost clearance and reduces driver lurch to the merest lateral shift. — DAVID DUNBAR

ON THE INSIDE

When does spare elegance become bland minimalism? We're not sure either. But neither phrase whispers "luxury SUV."

SPY REPORT

EUROPE BY MIKE ALLEN

Two Is A Lonely Number

Porsche may call its Panamera a coupe, but it has four doors.

It is possible that Porsche's success with the Cayenne has come at the cost of 911 and Boxster sales, which are down. Perhaps this has brought about the realization that folks with enough money to drive a Porsche need accommodations for more than two persons and luggage space for more than a couple of Spider-Man lunchboxes. This sleek four-door is slated for the 2008 model year. The Panamera (as it's called) will be shown next fall as a concept at the Frankfurt show. Like the long-gone 928 four-seater, the new car will be rear-drive and powered by a front-mounted V8. Porsche plans to sell as many as 20,000 per year—far more than the 928.

Land Of The Free

Land Rover concedes that its market is suburbia, not the rain forest.

Land Rover is bringing out a new Freelander in 2006, based on an all-new chassis. The three-door version is no longer part of the mix—all will have five doors. This is a much bigger vehicle, which will make it less capable off-road—but honestly, how many Land Rover customers leave the pavement? (Polo-field parking lots don't count.) The biggest change otherwise is the positioning of the engine: mounted transversely rather than longitudinally. There will be a couple of Volvo-produced gasoline engines, and a Ford of Europe diesel or two—but which powerplants will come to the States remains to be seen.

PHOTOGRAPHS BY BRENDA PRIDDY (TOP). HIDDEN IMAGE (BOTTOM)

Joining The Pack

For more than two decades it seemed every college student from California to Maine wanted a VW Jetta because it was cool. No more. The all-new Jetta is more reminiscent of a Japanese family sedan than the bargain BMW it was. Flip side: The new Jetta is a better car in every way. It's based on a rigid new platform. And it feels solid and weighted out on the road. Much of that newfound composure comes from its fresh, independent rear suspension, complemented by an electrically boosted steering system that feels more mechanically enhanced than most. Under the hood is a new 2.5-liter five-cylinder engine with 35 hp more than last year's. The engine can be paired to either a five-speed manual or a new six-speed automatic. The car weighs about 300 pounds more than before, so despite the extra moxie, don't expect a hearty sport sedan thrust. Inside, the Jetta is fitted with rich-looking, soft-touch materials. The car's interior is easily the best in its price class. Your $17,900 gets power windows and locks, and traction control. — BEN STEWART

More mainstream and less quirky than before, the Jetta is bigger all around.

VOLKSWAGEN JETTA

Sheep In Wolf's Clothing

As comfy as the M50 is, we'd still opt for the gel seat to further cushion our butts.

SUZUKI BOULEVARD M50

An M50 sounds more like something Arnold might use to vaporize cyborgs in "Terminator 4" than something you would ride to the Kwik-E Mart. But that's what Suzuki calls its new cruiser bike. But then who wants to brag about a cruiser with a wimpy name? The new Boulevard M50 has sinister styling befitting its appellation. Especially the $6749 black-on-black model we recently tested in Southern California (red or blue ones go for $6849). It's low-slung, has a raked back and looks a bit rebellious. Well, looks can be deceiving. The torque flow is smoother than 25-year-old bourbon. The beefy tires and well-damped suspension efficiently soak up pavement ripples. It may look like an outlaw's bike, but the M50 rides like a gentleman. — B.S.

Leave The Driving To Us

BY BEN STEWART

No key needed here, just electronic wizardry.

What used to be a sophisticated but purely mechanical device has evolved into a technological tour de force beyond the comprehension of mere mortals. That innocent-looking car sitting in your driveway packs more computing power than anything that's been to the moon. It's a wonder—and a testament to the automotive industry as a whole—that black boxes, circuit boards and microprocessors secreted throughout the nooks and crannies of the family wagon can control engines, transmissions, brakes and suspensions. And they do so essentially flawlessly, day in, day out, regardless of weather or climate.

This cornucopia of electronic brilliance has made cars cleaner, more fuel-efficient, more reliable, more durable and most certainly far more safe than they've ever been. All of which is good. And most people are rarely aware of the overseeing computerized hands guiding and protecting them as they drive, which is the way most people want it. But some of us are beginning to feel that this creeping automation is robbing us—okay, me—of a lot of the pleasure of driving. I want to be able to spin the tires under hard acceleration when I'm in the mood. I want to be able to get the tail of a rear-drive high-performance sports car to hang out there while I take a favorite corner. I want to know that I, not some HAL 9000 under the hood, am in control of my car.

Okay, not needing to turn a key in a switch to start an engine may be some people's idea of convenience. To me it's an easy way to lose track of the ignition key. What's the big deal? And why on Earth can't you get out of a new Corvette without having to have the engine off and the transmission in Reverse? What's next, cars that decide where to drive and when to drive there? I hope not. **PM**

Nurse Ginger Savely checks a patient, Miles Lawrence, for the lesions he says were caused by Morgellons.

Making Their Skin Crawl

People with creepy symptoms find a diagnosis on the Internet. But are they jumping to conclusions?

BY BENJAMIN CHERTOFF

Miles Lawrence, a landscaper in Florence, Texas, was supposed to be packing for a road trip to Las Vegas when he noticed his finger tingling. He stared in disbelief, he says, as "little spiny things" sprouted out of the skin where he'd just removed a splinter. He grasped one of the spines with tweezers and pulled.

Instantly, he says, a bolt of pain shot up his arm. He tugged on another one and the pain snaked up his neck. Then the really creepy part began. "It felt like bugs under the skin of my arms, in my joints," Lawrence says. "I freaked out."

Across the country, thousands of people complaining of the same horrifying phenomenon have formed an illness subculture. They share lists of symptoms, medical speculation and tales of run-ins with mainstream doctors at www.morgellons.org, the official Web site of a group called the Morgellons Research Foundation. It was founded in 2002 by Mary Leitao in McMurray, Pa. Leitao named the condition Morgellons Disease—after a disease with similar symptoms mentioned in a 16th-century medical text—while investigating a skin affliction on her then-2-year-old son.

Morgellons has barely registered on the radar of mainstream medicine. Few doctors have heard of the condition; fewer still know what to make of it. So when people walk into an examination room and announce they have Morgellons, they are often met with skepticism. Conflicts would seem to be inevitable.

"Dermatologists are afraid to see these patients," says Dr. Peter Lynch, professor emeritus of dermatology at the University of California, Davis. He says he has examined about 75 people with Morgellons-like symptoms in the past 35 years and believes they suffer from delusional parasitosis—literally, delusions of parasites in the skin. It's a diagnosis people don't like. One patient, threatening malpractice, convinced the state medical board to investigate Lynch. Another warned he had a pistol in the glove compartment of his truck, Lynch says. "He told me, 'I'm going to shoot the next doctor who tells me it's in my head.'"

LAB RESULTS

Members of the Morgellons online community say that, like those who suffer from breast cancer and AIDS, they merely want appropriate resources devoted to their illness. A letter-writing campaign recently netted a modicum of high-profile attention when U.S. Sens. Dianne Feinstein and Dick Durbin contacted the Centers for Disease Control and Prevention (CDC), asking whether the organization had investigated the illness. The answer was no. "Our laboratories are available," says CDC spokeswoman Jennifer Morcone. "But we need a clinically appropriate sample." So far, she says, they've only received samples sent in by patients.

There's a reason for that. Lynch and a number of other doctors say they have sent samples to hospital pathologists, medical labs and state health boards, which have uniformly failed to find any sign of an infection. If there's nothing tangible to investigate, there's no reason to call in the big guns at CDC headquarters.

PHOTOGRAPH BY BRENT HUMPHREYS

BACTERIA CULTURE

When Miles Lawrence sped to the hospital, he was told he had delusional parasitosis and that the weird spines were "just dirt." But over the next week his symptoms got worse. He scratched at his elbows and noticed more fibers, and little black specks. "It was like they were fighting back," he says.

Eventually, he found his way to a medical professional who does take the idea of Morgellons seriously. Ginger Savely, a nurse practitioner in Austin, Texas, says she has treated 35 patients with symptoms. "Everyone tells the exact same story," she says. "It's just so consistent." Savely prescribes her patients a course of broad-spectrum antibiotics. "If I knew what I was dealing with," she says, "it would be easier to treat." Yet, she says, her patients—including Lawrence—improve within weeks.

Other clinicians have likewise prescribed antibiotics. Dr. Raphael Stricker, a Lyme disease specialist in San Francisco, sees a handful of Morgellons patients—all of whom have tested positive for chronic Lyme disease. He thinks that *Borrelia burgdorferi*, the bacteria behind Lyme disease, has set his patients up for another, as-yet-unidentified, infection. And Dr. George Schwartz, a Santa Fe, N.M., trauma specialist, treats his patients with antibiotics targeted to *Stenotrophomonas maltophilia*—a usually harmless waterborne bacterium—and says he's seen them improve in only 48 hours.

HEAD GAMES

The apparent success of antibiotic treatment for Morgellons hasn't swayed doctors like Lynch—mainly because pathologists have failed to find an infectious agent. "These scientists can recognize things down to the prion level, and viruses that do everything to evade detection," he says. Lynch's preferred treatment: the antipsychotic drug risperidone—which works, he says, in as little as two weeks.

Another prominent dermatologist, who insisted on anonymity out of concern for his safety, says he has diagnosed 50 or so Morgellons patients with cutaneous dysaesthesia—a neurological disorder that can result in the sensation of scuttling insects. And the spiny things? "In every case I've seen it's a textile fiber, and it's on the surface of the skin," he says. He typically puts a cast over the lesions to prevent further irritation and after four weeks removes it. "Guess what?" he says. "The lesions are healed."

> ONE PATIENT WARNED LYNCH: "I'M GOING TO SHOOT THE NEXT DOCTOR WHO TELLS ME IT'S ALL IN MY HEAD."

Leitao and other Morgellons activists say that, with the Web as a primary tool, they'll continue working to have the illness investigated as an infectious disease. Doctors interviewed by PM say this unilateral approach hinders objective analysis of symptoms they've seen for decades. Well, all symptoms except for one: Widespread reports of the strange fibers date back only three years, to the time they were first described online, at www.morgellons.org. **PM**

Long-Term Tests

A rookie and an old veteran of the SUV wars join our test fleet as a very European station wagon leaves.

first report

PORSCHE CAYENNE S

To us it seemed sacrilege: a Porsche sport utility vehicle. It couldn't be. It shouldn't be. Surely Dr. Porsche would be spinning in his grave. We mean, Porsches have to have only two doors, right? And they have to be available as coupe as well as convertible. They're meant to race, to carve canyon roads, to destroy records at Le Mans and the Nürburgring. And they should never, ever be driven off the road.

Another lifelong belief shatters on the harsh realities of big cash.

So when the opportunity arose for us to add a Porsche Cayenne to our fleet, we took it. The temptation to see just how badly this engineering-driven sports-cars-to-the-core company could screw up the all-American life-in-suburbia icon, the SUV, got the best of us.

We specified a middle-of-the-line Cayenne S, the most popular model. It has a lot more moxie than the 247-hp V6-powered base model. But then again, it can't match the bodacious output of the more exclusive 450-hp Cayenne Turbo.

Our Cayenne arrived in time for it to experience the roller coaster weather that has been late winter and early spring on the East Coast.

Our first impressions were good ones: The interior is leather-trimmed

VITAL STATISTICS

Base price: $53,600

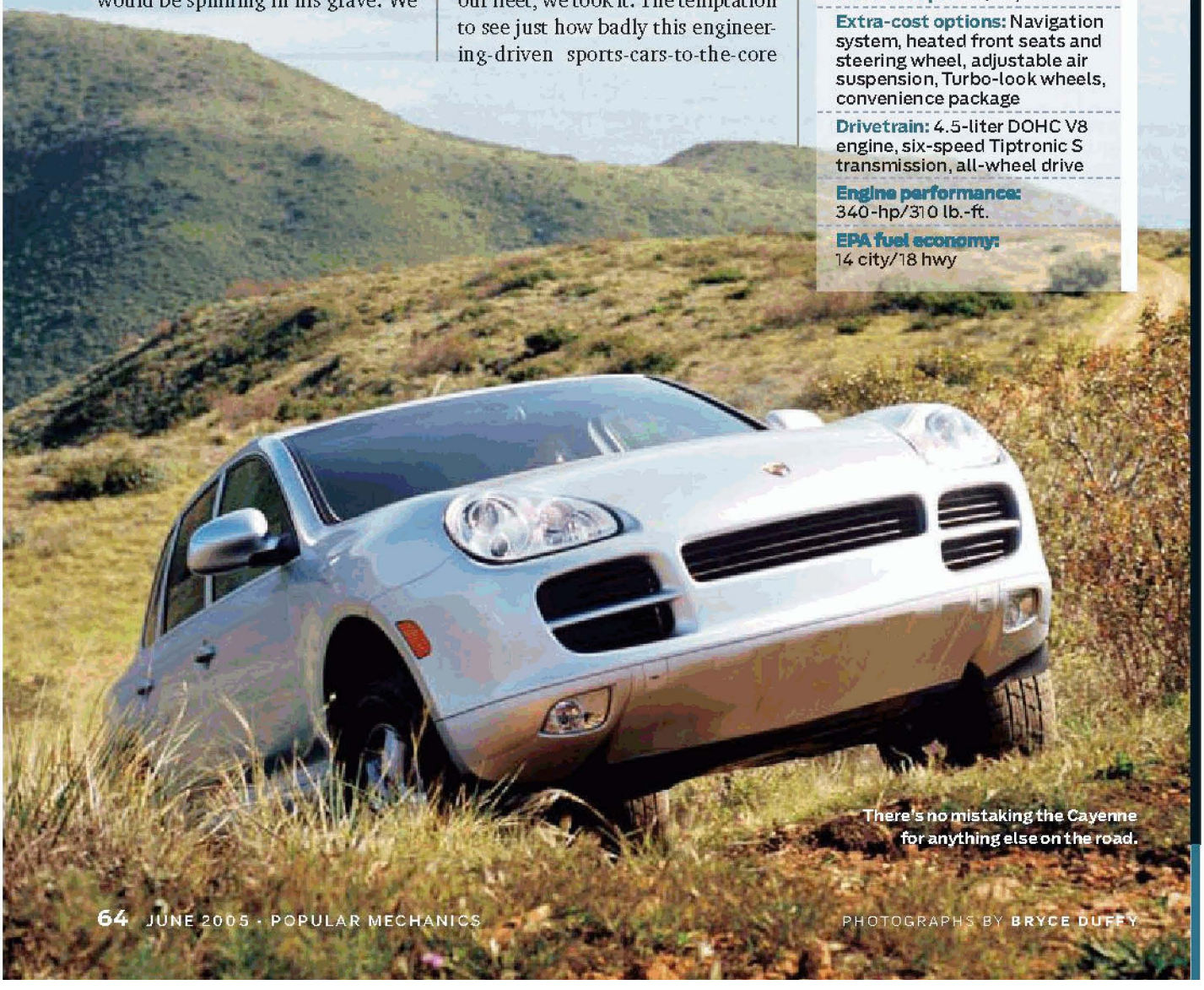
As-tested price: $68,100

Extra-cost options: Navigation system, heated front seats and steering wheel, adjustable air suspension, Turbo-look wheels, convenience package

Drivetrain: 4.5-liter DOHC V8 engine, six-speed Tiptronic S transmission, all-wheel drive

Engine performance: 340-hp/310 lb.-ft.

EPA fuel economy: 14 city/18 hwy



There's no mistaking the Cayenne for anything else on the road.

PHOTOGRAPHS BY BRYCE DUFFY

and the dash layout is purposeful. The dual-compartment center console and the two cupholders are downright usable for American-size stuff. The rear vents are appreciated by those sitting back there, though the rear seat is proving tight for big folks. The rounded, bulbous lines of the Cayenne may be an attempt to give it a Porsche-family appearance, complete with big cooling openings in the nose. But, suffice to say, not everyone appreciates the beauty of the carefully formed sheetmetal. Nor does everyone immediately take to the Porsche's sports-car-bred ride. This thing is way firmer than Superman's abs. And with an automobile, too much tautness is not always a good thing—especially on the cratered landscape that is our post-winter roads.

But the Cayenne is a Porsche. So it handles on pavement with more confidence-building tenacity than your average sport sedan; it will run loops around your basic lumbering SUV. More than that, its suspension is height-adjustable for both on- and off-road conditions. Speaking of off-road, this go-to-the-soccer-game all-wheel-drive SUV has a two-speed transfer case with a real Low range, just like your nastiest, get-down-and-dirty Jeep. We're looking forward to testing its mettle in the muck. This is one Porsche we won't mind getting dirty. — DON CHAIKIN

The heated steering wheel with audio controls is nice. A nav system that goes off with the stereo is not.

Bigger and brawnier, the latest Subaru Outback is technically now a truck.

SUBARU OUTBACK

While Porsche may be a relative Johnny-come-lately to the bustling world of half-a-car/half-a-truck sport utilities, Subaru is a founding father. So when Subaru unveiled the latest version of its core model, the Outback based on the Legacy line, we ordered one for our fleet.

Specifically, we wanted one that was bristling with some of the technology that was new to Subaru, including the six-cylinder engine with its typically unique Subaru take on variable valve lift and timing, and the driver-shiftable five-speed automatic transmission. Specifying that powertrain meant getting an Outback with a window sticker starting about $10,000 above what you can spend for a lesser Outback. Despite the difference in price, both Subarus offer the carmaker's hallmark all-wheel drive in essentially the same wrapper.

The most obvious refinement to this third generation of Outbacks, and to the Legacy from which it spawned, is the increase in size. The Outback sits on a wheelbase that's nearly an inch longer than its forebears' and overall is almost 2 in. longer. With the larger size, Subaru classifies the Outback as a truck, not a car. This helps the company dodge some strict fuel economy standards. Along with a growth spurt, the Outback has had a safety spurt and is now equipped with front-seat side airbags as well as curtain-style airbags. Convenience features now also include heated front seats, outside mirrors and a windshield wiper de-icer.

VITAL STATISTICS

Base price: $33,495

As-tested price: $34,351

Extra-cost options: Auto-dimming mirror with compass, security system with perimeter alarm

Drivetrain: 3.0-liter DOHC six-cylinder opposed engine, five-speed automatic transmission with Sportshift, all-wheel drive

Engine performance: 250-hp/219 lb.-ft.

EPA fuel economy: 19 city/25 hwy

PHOTOGRAPHS BY BRYCE DUFFY (BOTTOM LEFT), CHRIS ROGERS (SUBARU)

Going uptown with a wood, leather and brushed-metal interior.

We took delivery of our top of the line Outback 3.0 (which brought a six-CD changer, power front passenger seat and a wonderfully huge dual-pane glass sunroof) in time for the uncivilized weather that marked metro New York's early spring. Happily, nothing in Mother Nature's arsenal could stop our intrepid traveler. The Outback was pressed into service for a family vacation that attempted (somewhat successfully) to outrun the weather by heading south. That added sand and seashells to the salt residue and caked mud that already coated the exterior.

Uncomplaining, the Outback is proving to be roomy, easy to drive and, so far, as reliable as an anvil. As for the eagerly awaited new six-cylinder, it's not a screamer, like some Subaru turbos. But the torque builds steadily as you leave your foot down on the accelerator and the car has no trouble merging with and passing traffic as you want.

Now as spring melds into summer, we'll get the air conditioning and CD player pumping. We'll let you know if it deals with the heat and humidity as well as it did the frigid slop. — D.C.

second report

SCION xB

It's cheap, funny looking and noisy. So why do we love our Scion so much? It's practical for one thing. Zipping around town and squeezing into parking places—it's a perfect errand car. And, reports one teenage driver (Toyota's target for this hot new brand): "You can fit all your friends in it and not feel crowded." Plus, it's surprisingly fun to drive (if you don't mind working its gutsy little engine). It's a go-kart for (almost) grown-ups. — JIM MEIGS

DRIVERS NOTEBOOK

- Great visibility—why can't luxury cars offer such 360° views?
- The instruments are grouped in the center of the dash—a smart, simple approach.
- When's the last time you filled up your tank without breaking a 20?
- The Pioneer CD player recognizes ID3 metadata text (so it can tell you what song is playing on CDs you've burned yourself).
- Wish it had side airbag curtains.

DATA SO FAR

As tested: $16,928 **Previous reports:** See 3/05 **Miles driven:** 7083 **Miles since last report:** 6322 **Fuel economy:** Average—27.2 mpg, Worst—19.6 mpg, Best—34.3 mpg **Maintenance/repair costs:** Scheduled service, $45.62

third report

NISSAN TITAN SE

What's the best way for a West Coast editor and his East Coast dad to reconnect? Road trip! Cross-country, mano a mano in the Titan. Fast. Comfortable. Enough room in the big cab for each of us to have his own space. En route, the front brake rotors began warping, but Santa Monica Nissan installed thicker rotors and new pads under warranty. Now the Titan is our West Coast workhorse—and frequent commuter. — BEN STEWART

DRIVERS NOTEBOOK

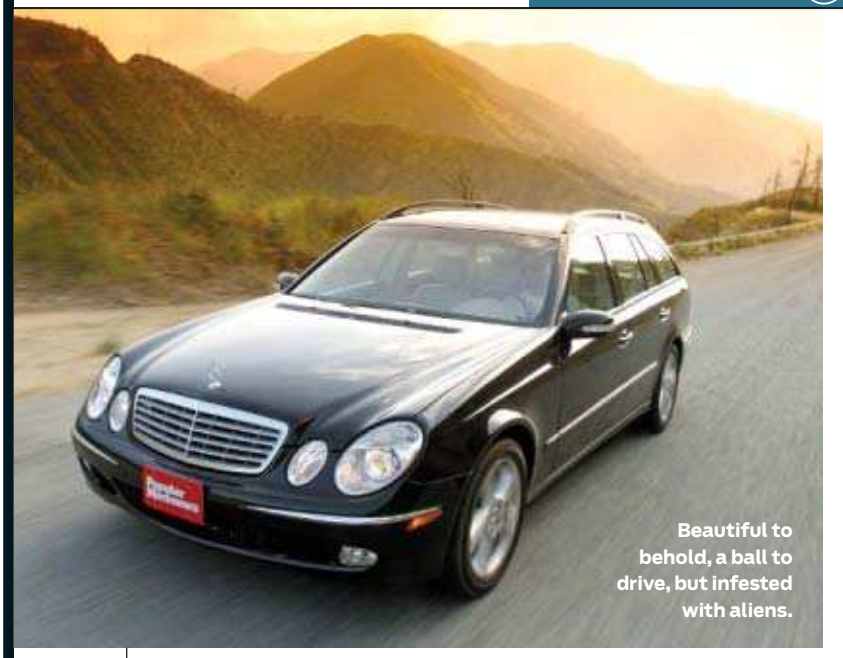
- Vehicle stability control great in snow but intrusive on pavement.
- Full-size exterior a little too full-size for normal parking spots.
- Roomy interior is awash with cupholders and storage cubbies.
- Chintzy interior materials already showing signs of wear.
- iPod anyone? Plenty of power ports.
- Five-on-the-tree shifter has a manual gear-change button.

DATA SO FAR

As tested: $30,890 **Previous reports:** See 3/05, 11/04 **Miles driven:** 10,445 **Miles since last report:** 6152 **Fuel economy:** Average—15.5 mpg, Worst—11.7 mpg, Best—16.8 mpg **Maintenance/repair costs:** Scheduled service, $76.27

ABOUT PM'S LONG-TERM TESTS POPULAR MECHANICS's auto editors drive more than 200 new cars and trucks every year. We subject the newest, most significant ones to the rigors of a long-term test—typically for 12 months. Our regimen includes real-world driving under a variety of conditions—city, country, suburbia, empty and full. Our testing also includes a thorough assessment of the cost and difficulty of getting the vehicle serviced at the dealership. We use these vehicles to commute daily to and from our offices in New York City, Santa Monica, Calif., and Detroit. Over the course of the vehicles' year with us, we let you know what breaks, what's exciting and good, boring and bad. Our goal is to help you make a sounder decision when you shop for your next new car or truck.

PHOTOGRAPHS BY CHRIS ROGERS (TOP LEFT), VINNIE DONIZETTI (SCION AND NISSAN)



Beautiful to behold, a ball to drive, but infested with aliens.

final report

MERCEDES-BENZ E500 4MATIC

For 17,000 miles, our Blitzen Black Benz wagon has given us driving fun, and swathed us in luxury and comfort. And for most of that time, it's been a faithful servant. Given this car's size, weight and potency, we come away impressed with its fuel economy. We've driven it hard and fast, getting a consistent 22 to 23 mpg at traffic-devouring speeds.

One complaint about the drive-by-wire powertrain: When getting rolling from a stop, even a gentle tickle of the throttle pedal gives a healthy acceleration—but just a slight bit more kicks in the afterburners and spills the latte. But we love how the sedate-looking wagon is so capable of dustin faster-looking cars.

Alas, the Benz's reliability is not what we've been accustomed to. We won't blame the car for the tire destroyed by a pothole, but there have been a rash of other minor issues. The hood-open warning lamp flashes every minute or so, though the hood is closed. And the audio/nav system seems haunted by aliens making spaceship-like noises even if it's turn . Then the nav system can't seem to find its bearings here on planet Earth for several hours. Hmm ... — MIKE ALLEN

DRIVERS NOTEBOOK

- Massaging, heated/cooled front seats with active side bolsters are worth the price of admission.
- Truly invisible all-wheel-drive system made a mockery of the snowy winter.
- Drive-by-wire throttle and normal Second gear starts made getting rolling smoothly an art.
- Too many annoying electronic glitches.
- We're still waiting for a new handle for the third-row seat.

DATA SO FAR

As tested: $68,740 **Previous reports:** See 3/05, 11/04, 8/04 **Miles driven:** 17,023 **Miles since last report:** 3381 **Fuel economy:** Average—17.3 mpg, Worst—12.8 mpg, Best—23.9 mpg **Maintenance/repair costs:** Tire, $162.47; scheduled service, free

PHOTOGRAPH BY VINNIE DONIZETTI

Put together a tech-hungry family, the expertise of Popular Mechanics, and a whole lot of cutting-edge digital gear and what do you get? The ideal forum for conducting an in-depth, months-long test of electronics for the home. Every week, it seems, equipment makers announce advances in wireless networking, PC design, voice-recognition technology, digital video recording and more. The goal of the three-part PM Digital Family project is to see how well the latest technology is doing its job. Are the newest products simple to set up? Do they play well with other technologies? Is the juice worth the squeeze? Jamieson and Peggy Jones, a 40-something couple with two school-age children, are helping us find out.

Here in Part One, we chronicle the ups and downs of our test family's relationships with PCs and networking gear. We'll visit the Joneses twice more in the coming months to report on their experiences with home entertainment and automation.

1 FIRST IN THE DIGITAL FAMILY SERIES

Meet The PM Digital Family

BY REBECCA DAY

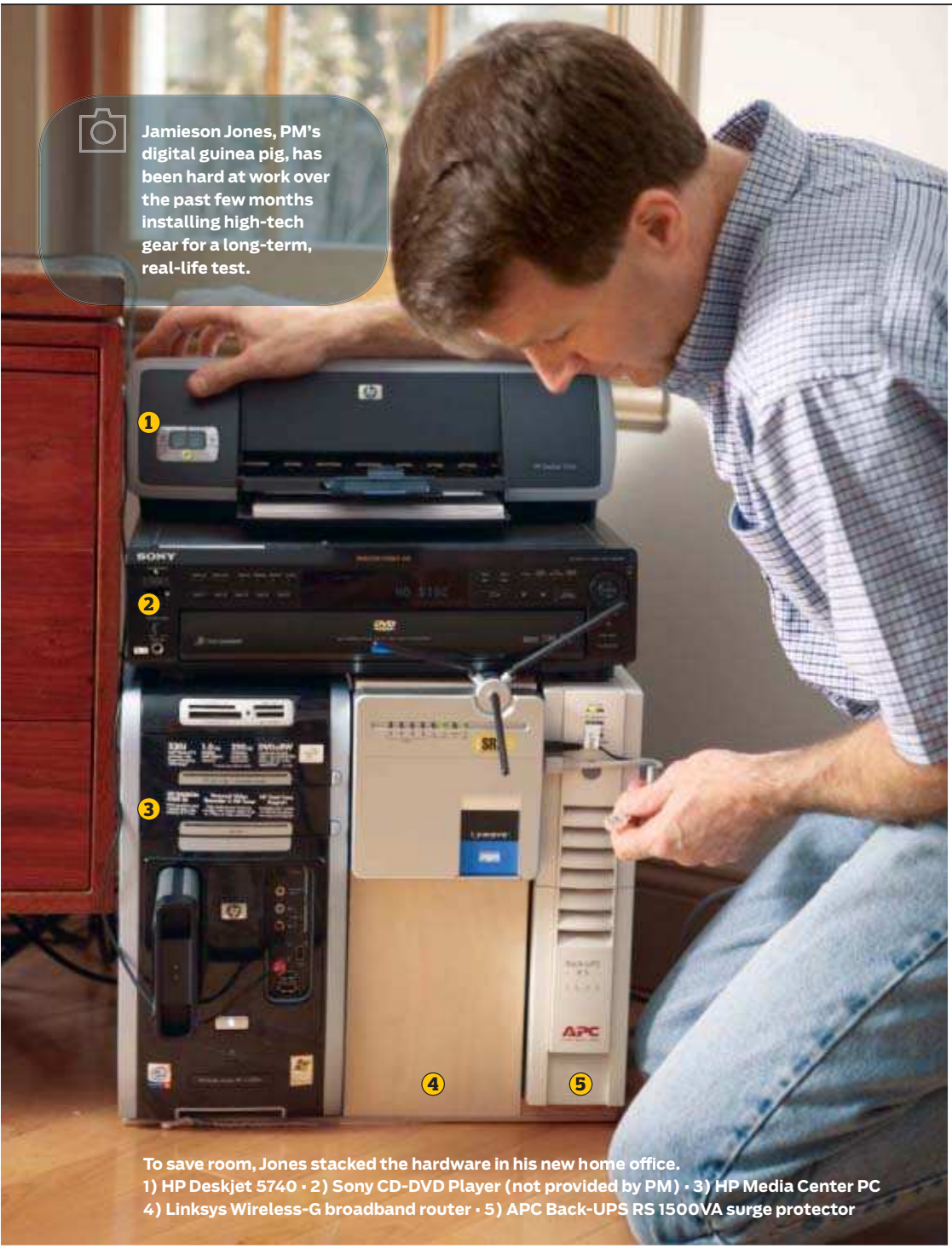
We needed a set of PM readers to install and test every must-have piece of high-tech wizardry any family could drool over. It's good to be the Joneses.

First Meeting

We sat down with Jamieson and Peggy on a midwinter day in the living room of their light-filled, contemporary home on 3.5 acres of rural northwestern Connecticut. They'd bought the house half-built and then finished it themselves with lots of skill and energy, and a heavy dose of perfectionism—installing floors, moving walls and ripping out a finished staircase that somehow wasn't quite right. The Joneses were a mass of technology contradictions. Jami, a successful, hyperkinetic inventor and self-taught engineer, has a computer-controlled lathe and milling machine in the basement (not to mention a pile of junk in the corner that he's planning to turn into a motorized inline trike). Yet most of his design work involved peering at the 12-in. screen of a four-year-old laptop in the den. Jami was sharing that PC with 8-year-old Ben, whose schoolwork was requiring more and more computer time. And Peggy—the family scheduler, photographer and historian—lived a paper-chase life of hand-scrawled notes to herself, while squeezing in her own Internet sessions and digital imaging when she could. Their 6-year-old, Nina, was poised to put more stress on the family's thin PC resources as she got older.

STYLING BY ALISON SHERR. PILLOWS BY CRATE & BARREL

PHOTOGRAPH BY **ALISON ROSA**



Jamieson Jones, PM's digital guinea pig, has been hard at work over the past few months installing high-tech gear for a long-term, real-life test.

To save room, Jones stacked the hardware in his new home office.
1) HP Deskjet 5740 • 2) Sony CD-DVD Player (not provided by PM) • 3) HP Media Center PC
4) Linksys Wireless-G broadband router • 5) APC Back-UPS RS 1500VA surge protector

Over the course of a few hours, we helped establish goals for a digital redesign. Eventually, this stage of the project netted the Joneses over two dozen pieces of gear, from the lustworthy (a big plasma monitor) to the humble (the best darned surge protector you can find). Most of our entertainment and home automation ideas were put on hold for the time being.

>> Jami's wish list: A bigger monitor, more computing muscle and a big-screen videoconferencing setup. Jami volunteers at Ben's school, teaching accelerated math; he wanted to run the class from home.

>> Peggy's wish list: A personal digital assistant—and anything else we could dream up for handling schedules, addresses and shopping lists. For e-mail and the Internet, she wanted her own laptop that she could take from room to room. And finally, a better way to edit, organize and store the thousands of digital pictures she's taken.

>> Plus: Jami and Peggy wanted creative ways to help the kids use computers for school and extracurricular learning—all within sight of their parents.

The Do-It-All PC

Over the next few days we sketched out an equipment plan that would turn the Jones household into an utterly wired (and wireless) digital engine of work and family life. Products started arriving early in February.

We chose the den as the Jones family digital hub, with a Hewlett-Packard Media Center desktop PC at its heart. The PC would serve as a vault for the family's 4000 digital images and 3000-plus MP3 files, and operate as a digital video recorder, snatching Food Network shows for Peggy, and Peggy-approved TV shows for Nina and Ben. The HP would make a worthy workhorse for Jami's engineering and math software, while the

Hewlett-Packard Media Center PC

roomy 19-in. monitor would let him view several applications at once. We chose a Linksys wireless router as the house's networking base, and tapped Logitech for Web cams and headsets for the videoconferencing project. Support gear—video cards, security software and so on—came from Iomega, American Power Conversion (APC) and Norton.

Jami Jones has an unusual knack for cracking technological problems, but perhaps less-than-average patience for missteps in design or instructions. For instance, he didn't like the fact that his network setup quickly required calls to Linksys tech support. "The software prompted us for a domain name," Jami reported in his e-mail journal, "but tech support tells us we don't need a domain name for home use. If you don't need a domain name for a home network, they shouldn't make it part of the setup process." A more enduring irritation by the end of February was the proliferation of power cords. "They're everywhere!" he wrote.

Many a family has a PC in the den; few, other than PM's Digital Family, have it connected to a 42-in. LG plasma TV. Sure, it works as a television. More critically, though, it's the monitor for Jami's videoconferencing project with Ben's school—which he hopes to extend to other schools in the district. "The plasma is ideal because of its size," says Jami. "You don't want the image of the person you're conferencing with hidden under other applications." The 19-in. monitor went on a desk, but finding a home for the 80-pound plasma put Jami's engineering smarts to the test. He built a frame in the corner of the room using a crossbar made of

PM's Rebecca Day plots a makeover.

steel angle-iron mounted atop high-grade plywood braces painted black. Underneath, he screwed two additional wood braces to the house's frame. (Manufacturers strongly recommend against homeowners hanging these heavy, yet delicate, screens on their own.)

On March 8, Ben and Jami conducted their first videoconferencing practice run, with Ben on a PC upstairs and Jami downstairs in the den. Both could work on a shared math document at once, with Jami getting a good look at Ben and his progress on the big screen. "I watch him work on the problems, and we

EQUIPMENT LIST

ce/Den:

HP Media Center PC m1270n ($1179)

HP Pavilion F1903 19-in. monitor ($349)

LG DU42PX12X MAP 42-in. Plasma TV ($3299)

HP Deskjet 5740 ($89)

PalmOne Zire 72 ($299)

Logitech QuickCam for Notebooks Pro Webcam ($99)

Logitech QuickCam Orbit Webcam ($129)

Logitech Internet Chat Headset ($24)

Norton Internet Security 2005 software ($69)

Linksys Wireless-G broadband router with SRX (WRT54GX) ($199)

Linksys Wireless-G PC Card with SRX (WPC54GX) ($129)

APC Back-UPS ES 725VA ($99)

APC Back-UPS RS 1500VA ($299)

APC Performance SurgeArrest ($39)

Iomega External 160GB Hard Drive FireWire 800/FireWire 400/USB 2.0 ($199)

ATI Radeon X850XT Platinum Edition video card ($549)

Kitchen:

Dell Inspiron 700m ($1546)

Dell Photo Printer 540 ($149)

PalmOne Tungsten T5 ($399)

Family Room:

Sony VAIO VGC-V517G TV PC ($1799)

Acer C110 Tablet PC ($1499)

Griffin radioSHARK ($69)

SanDisk CompactFlash PC card adapter ($9)

Epson Stylus CX4600 ($129)

Epson Stylus CX4600

Logitech Internet Chat Headset

LISTEN UP

Joneses' 5 Suggestions For The Computer Industry

1. CLEAN UP YOUR ACT ON FIREWALLS. It's great that Microsoft XP, Norton Internet Security and Linksys routers all provide firewall protection—but not if it takes hours to find out they can't work together.
2. REDUCE THE CLUTTER. Desktops on just-out-of-the-box PCs are a mess. Put any programs other than primary applications into a "try if you like" folder.
3. GO SILENT. Add a mic mute button as a specialty keyboard function. As VoIP (Voice over Internet Protocol) and videoconferencing develop, we need a simple way to control voice input.
4. LABEL THE CORDS. Does this cord go to the printer? The monitor? The scanner? Start shipping every connector and power cord with an ID tag.
5. WHILE YOU'RE AT IT... Standardize your power cords. Every device comes with its own, unique power plug. If you guys are as smart as you're supposed to be, you can make them interchangeable.

can talk over the microphones," Jami wrote. Now they just have to work through some red tape for networking at school.

THE JONES AWARD: The APC Performance SurgeArrest became a surprise star early in the test. Unlike most surge protectors, Jami says, "its outlets are spaced widely enough to accommodate bulky power supplies."

The Organizer

The den might be computing central for the Joneses, but the kitchen is the nerve center of nearly every home. There, we supplied Peggy with a Dell Inspiron laptop, a radio recorder, a Dell personal printer and a space-efficient Epson all-in-one printer/scanner/copier. We also snagged her a PalmOne Tungsten T5 PDA.

The first, and biggest, benefit Peggy reported was simply having her own machine. "I love not having to compete with Jami or the kids for computer time," she told us in early February. Peggy began typing Ben's and Nina's schedules into Outlook and syncing them with her Palm: Nina's activities are in pink and Ben's in blue for quick (and gender-traditional) identification. That convenience met her expectations; some other stuff exceeded them.

The Joneses' HP Media Center PC is connected to two monitors, facilitating videoconferencing.

For instance, we provided Peggy with Griffin's radioSHARK, a USB peripheral that provides radio reception to a PC. Now, when the local NPR station airs a program she's not home to hear, the radioSHARK records it for her. Peggy downloads the file to a Flash memory card and listens to it later on her PDA. She also started copying recipes to the Palm, then turning it sideways to read them in landscape mode while cooking. She started logging her shopping list, by store, using Splash Suite software—and even downloaded an e-book to read on the backlit device in bed. ("I don't have to turn on a bedroom light," she wrote.)

The Epson all-in-one quickly became a much-used household tool. Because it's a color copier, it saves on trips to Staples for school projects. Peggy also uses the Epson to scan in old family photographs along with paperwork from the kids' school that she then stores on the PC.

THE JONES AWARD: Peggy brought her digital camera and the portable Dell Photo Printer 540 to a mother/daughter tea party and printed out pictures for all the guests. Besides portability, the printer won praise for letting the family bypass PCs when viewing images and making prints. "Sometimes Jami and I take pictures separately and we can't remember what's on the card," Peggy says. "Now we just drop the card in the printer and look at the LCD."

Going Beyond Keyboards

From the kitchen, Jami and Peggy have a full view of the family room, making it the ideal location for a 17-in., all-in-one Sony VAIO, which fits hard disk, DVD recorder and memory inside a chassis just 3 in. deep. In the Joneses' home it also functions as a TV and radio. "I never would

Sony VAIO All-in-one 17-in.

have thought that a product could be superior as both a TV and PC," Peggy says. While the VAIO system setup went smoothly, there was no built-in networking functionality. Shortly after ripping open the box, Jami added the machine to the network using a Linksys PCI network card.

The final piece of the PC puzzle was a 3-pound Acer C110 Tablet PC, with a screen that takes handwritten input from a stylus. The idea was to ease Nina into computers with a portable PC she could draw on and then help her transition to typing with the Tablet's virtual keyboard. The Joneses' journal entries for Feb. 24 show Nina playing video paintball and practicing her spelling, and Ben using the Tablet PC Music Composition Tool to compose and play songs.

One snag in the plan to let the kids dominate the Tablet was that Peggy and Jami quickly took a liking to it, too. In fact, Jami, who prefers writing and dictation to keyboard input, says that the Tablet is now his first choice among the portable PCs. And most of his e-mails to PM were composed using voice-recognition software, which he trained to work with about 90 percent accuracy. (Oddly, though, the software consistently transcribes "voice recognition" as "Boise recognition." Go figure.)

THE JONES AWARD: The Tablet PC became a hot item in the household for its versatility (despite crashes early on and some complaints about screen brightness). One revelation was its usefulness as an e-book platform once Peggy came across free children's books on the University of Virginia Web site. "Reading books is a great use of the Acer," she commented. "It's like going to the library without leaving home."

After Two Months

The family's report card one-third of the way through their lives as high-tech lab rats? Early on, kid-in-a-candy-shop glee was tempered with daily rants about product crashes, incompatibilities and file-sharing snafus. "Just when we're having fun with one thing I'll hear from somewhere in the house 'my music's not working' or 'this one crashed,'" Jami reported in early March. But a couple of weeks later, the connectivity snafus were distant memories. "I take the network for granted now!" wrote Peggy. "I carry the laptop around without even thinking about connectivity issues. It feels like we've always had these PCs."

Dell won praise for lightweight design.

One surprise was that some of the least sexy equipment turned out to be the most appreciated. For instance, when a late-winter storm on March 11 caused two power blips, an APC power backup kicked in as designed to keep the HP Media Center PC running. "One of my biggest worries has been about momentary power failures and losing data," Jami noted. "That worry is over."

The Joneses are looking forward to the next phase of their stint as PM's Digital Family, when we pack their house with much of the best and latest entertainment equipment. But Jami has already come to one conclusion about the state of the digital world. "Technology is more reliable than it used to be," he says, "but it took a lot more time to get it working than many people would have put up with." PM

A pair of compact PCs: the Sony VAIO (l) and the Acer Tablet.

Couch To Combat

A popular computer game called "America's Army" has evolved into a high-tech tool for training today's soldiers.

BY FRANK VIZARD

Bossant uses a gas-powered .50-cal. machine gun in a training simulation. Guns in the online game (below) are, of course, virtual.

Phillip Bossant doesn't shoot guns. Sure, he's been on a firing range once or twice, but that was amateur stuff—pistols and a shotgun—not military-grade weaponry. But there, before him, on a table in a room on a military base in southeast Wyoming, lie the pieces of an M16. The 40-year-old art director glances down at the rifle and then up at the infantryman who has just told him to assemble it. "Never in a million years," he says, "did I imagine I'd be doing this."

Bossant and 29 other creatives, programmers and technical gurus recently left the soft glow of their computer monitors for Camp Guernsey—an Army training facility favored for the surrounding terrain's resemblance to Afghanistan. As the developers of "America's Army," a networked online PC game played by more than 5 million armchair soldiers, they went there seeking the kind of realistic detail that has made the game wildly popular. Their nuanced observations, incorporated into a training simulator, are even helping real soldiers better prepare for war.

"Every bit of exposure to people, equipment, location, designs and plans we can get makes our chances of achieving realism better," says Bossant. "Holding, even firing, one of those live weapons really brings home what you're dealing with. It gives you that extra edge. When there's a weapon reload, we want soldiers to say, 'That's it! That's just what it feels like.'"

GAME ON

Since it debuted in 2002, the game's publisher—the Army itself—has poured $5 million per year into expanding and upgrading "America's Army." By engaging today's media-savvy youth, the Army hopes to attract new recruits through a medium they already identify with: computer games. While still sitting at home, players become fully immersed in an Army mission. They complete virtual training and then take on specialized squad roles, such as fire team leader or combat medic. During simulated combat with other networked players, they wield virtual weapons such as thermite grenades. And if they fail to follow the rules of engagement, they may even find themselves sitting in a virtual Fort Leavenworth.

The game's dedication to authenticity has proved useful not just for attracting soldiers, but for training them as well. A simulator based on "America's Army" game technology puts actual soldiers with real

PHOTOGRAPHS BY BENJAMIN LOWY

weapons (albeit fitted with laser targeters) in a theoretical scenario played out on three large screens.

Unlike the Army's standard Firearms Training Systems—which consume a huge chunk of whatever buildings they occupy and require several operators to run—the new "America's Army" version packs into suitcases. It is now being deployed to military bases to help soldiers keep their skills sharp.

The simulator offers a level of precision firing not available in the civilian version. But it does more than hone aim: It tests how soldiers respond to increasingly difficult circumstances. A new convoy training exercise, for example, requires the driver and gunner of an armored Humvee to act in tandem to complete their mission. The programmed rules reward teamwork and valor and penalize actions like inadequate preparation, cheating and Rambo-like behavior.

"Soldiers must learn how to react adaptively and creatively," notes Col. Casey Wardynski, director of the "America's Army" project. "It's not just about operating big weapons systems. We want to build a virtual world where the decisions you make impact the future."

VIRTUAL FRONTIER

During a visit to Camp Guernsey I put my own military prowess to the test. Before long I am moving up an alley in the "America's Army" simulator. The images are all electronic, but the pistol in my hand makes the situation feel real. Suddenly, a man with an assault rifle appears in a window. I fire three rounds in his direction. He's down. Another three attack and I fire until they go down, too. When I reach the end of the alley, an armed assailant pops out of a doorway. I squeeze the trigger, but instead of a satisfying bang and recoil all I hear is a wimpy click.

"One target, one bullet," cautions the instructor as I prepare for my resurrection from the dead and another go-around with the enemy. I just learned a critical lesson in ammo management; I also found out I'm not the guy to call if you're looking for accuracy. My military skills set rests with what the Army kindly calls "suppressing fire."

The military also uses "America's Army" technology to evaluate new weaponry in a virtual battlespace. At the Picatinny Armament Research, Development and Engineering Center in New Jersey, soldiers use a simulator to practice controlling a TALON equipped for explosive ordnance disposal. The robot, about the size of a large dog, is currently being used to dispose of bombs in Iraq. Its human operator views the terrain remotely and maneuvers it with the same controls used during training exercises.

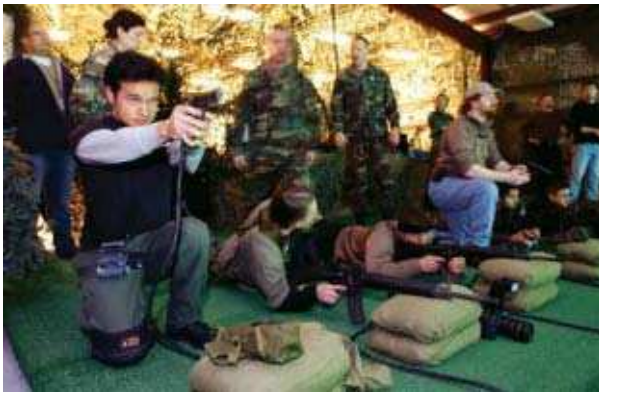
Soldiers also gain experience with XM-25 assault weapons, which allow the highly accurate placement of airbursting grenades, and with virtual Stryker infantry carrier vehicles. Future simulators could include handheld Javelin anti-tank missiles and the SWORDS TALON, which can be equipped with a .50-caliber sniper rifle, a machine gun, a rocket launcher or a grenade launcher.

"['America's Army'] is about more than just getting a rise out of teenagers," says Bill Davis, executive producer for the "America's Army" Future Applications team at Picatinny. "Being able to explore new weapons technology virtually has been a goal of simulations for a long time."

As the military pushes forward with new functions for "America's Army," the Public Applications team, led by executive producer Bossant, is constantly improving the online version. New occupations, units, technologies and adventures are being developed for an upgrade due out this year. Also on tap are technical enhancements that will make tournament play run more smoothly. This summer "America's Army" moves on to profit-driven video game platforms like Xbox and PlayStation.

As for Bossant's brief four days as an Army grunt, his experience—from target practice to 3000-calorie "Thai chicken" MREs—will translate into yet more realistic detail on the screen. "You don't have to be familiar with, or even interested in, the Army," he says, "but it's impossible to walk away from this game without an understanding of what the real Army is like." PM

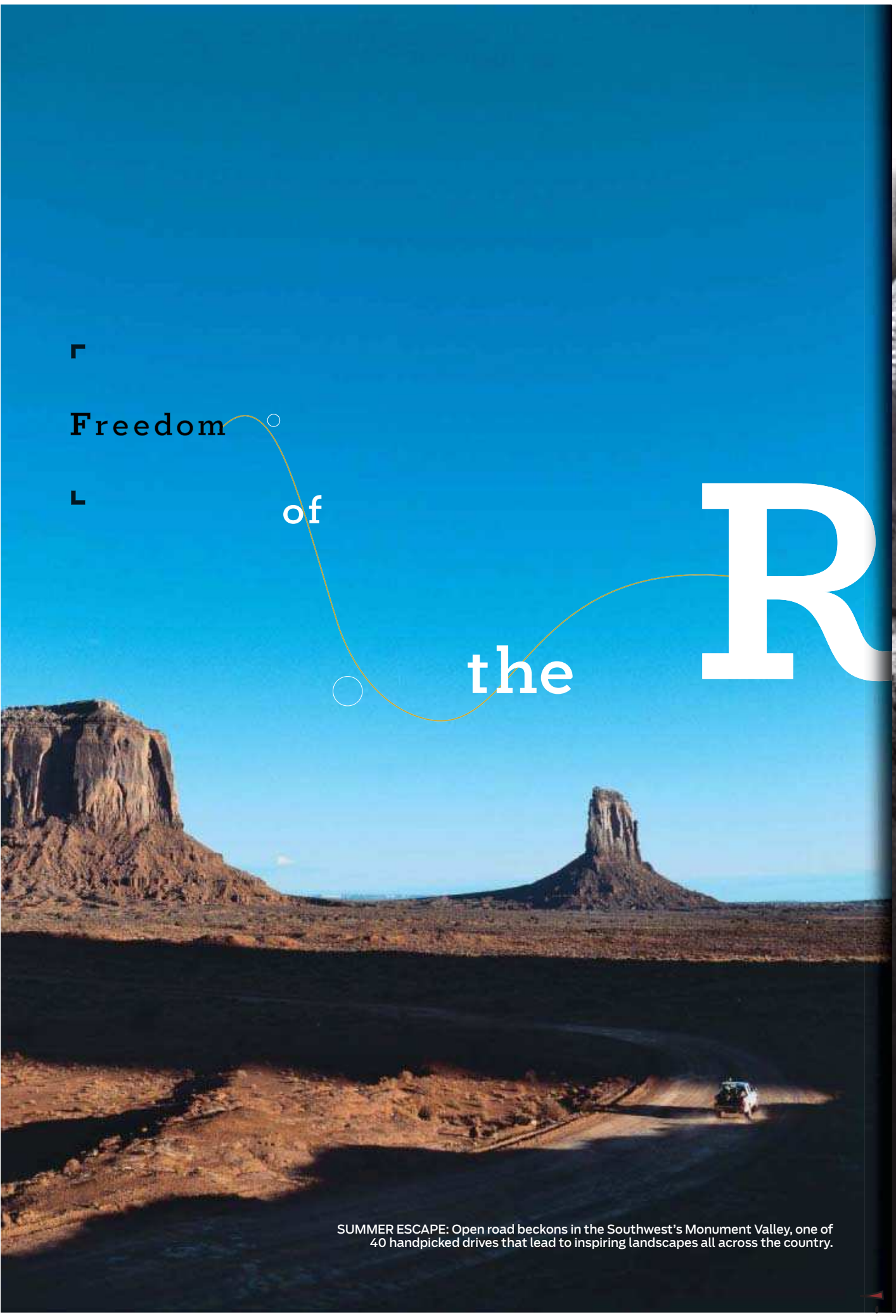
Civilian game developers learn about the Army the hands-on way.



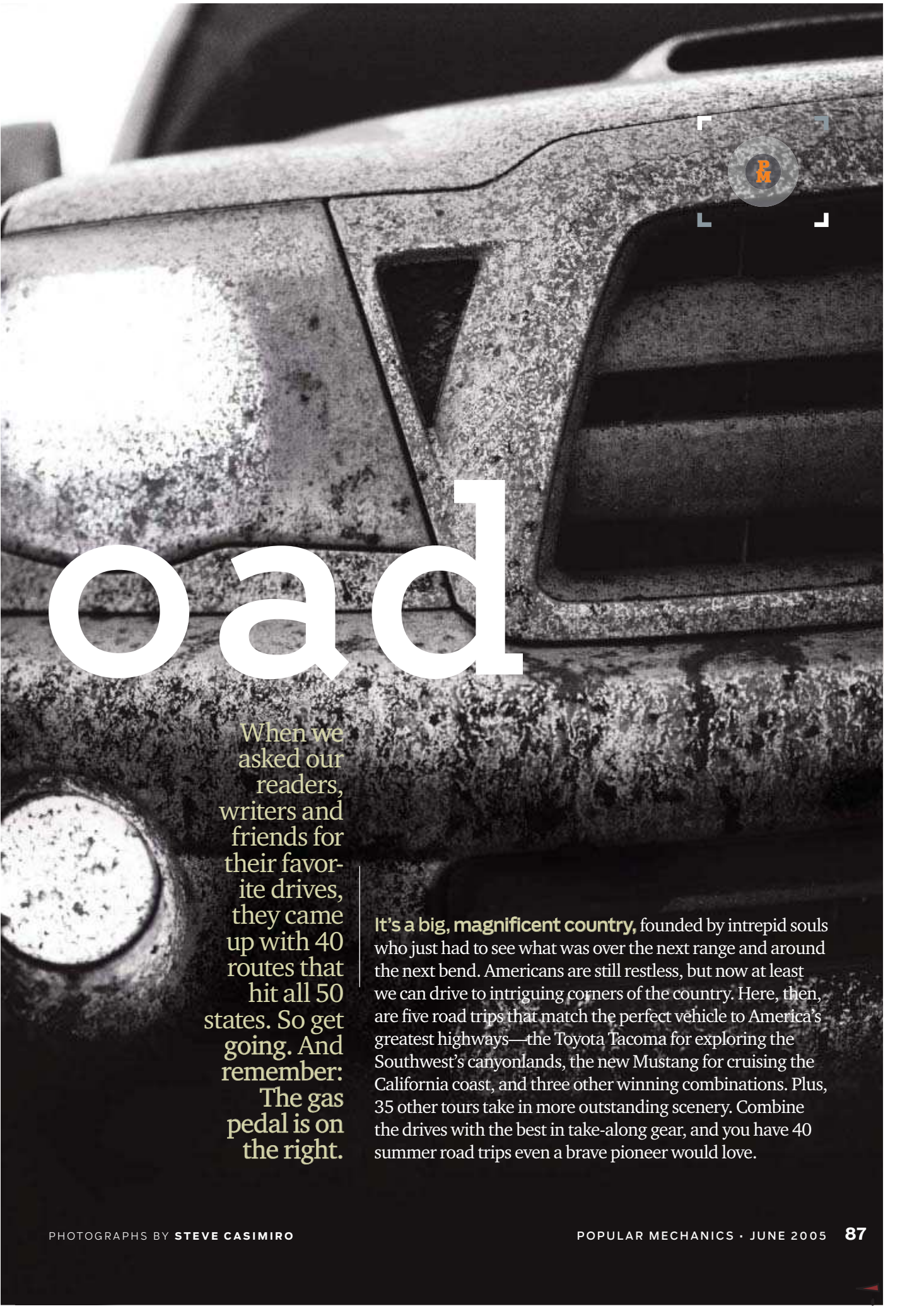
PHOTOGRAPH BY CARMEL ZUCKER

"'AMERICA'S ARMY' IS ABOUT MORE THAN JUST GETTING A RISE OUT OF TEENAGERS."

Freedom of the R



SUMMER ESCAPE: Open road beckons in the Southwest's Monument Valley, one of 40 handpicked drives that lead to inspiring landscapes all across the country.



oad

When we asked our readers, writers and friends for their favorite drives, they came up with 40 routes that hit all 50 states. So get going. And remember: The gas pedal is on the right.

It's a big, magnificent country, founded by intrepid souls who just had to see what was over the next range and around the next bend. Americans are still restless, but now at least we can drive to intriguing corners of the country. Here, then, are five road trips that match the perfect vehicle to America's greatest highways—the Toyota Tacoma for exploring the Southwest's canyonlands, the new Mustang for cruising the California coast, and three other winning combinations. Plus, 35 other tours take in more outstanding scenery. Combine the drives with the best in take-along gear, and you have 40 summer road trips even a brave pioneer would love.

PHOTOGRAPHS BY **STEVE CASIMIRO**

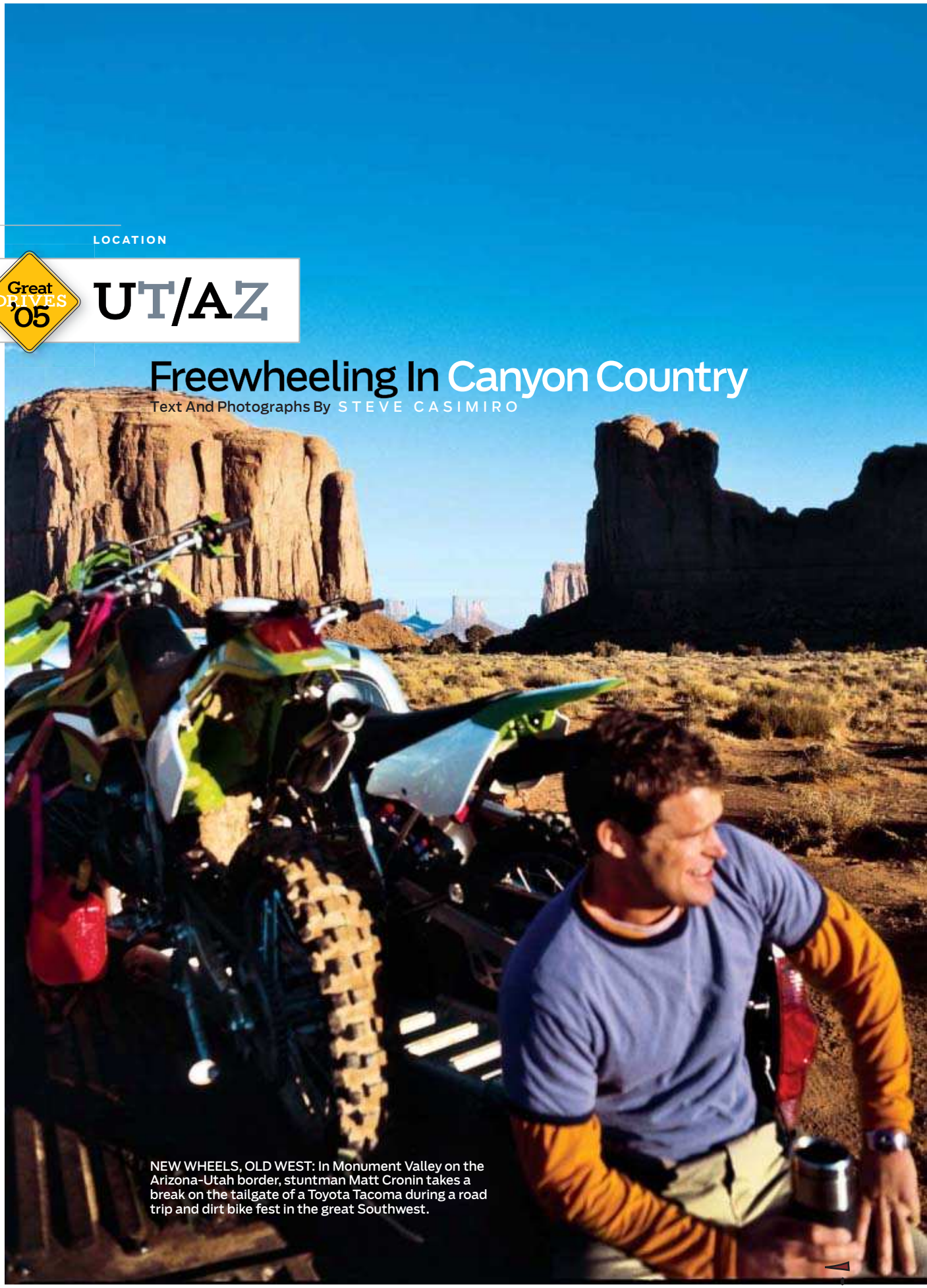
LOCATION

Great DRIVES '05

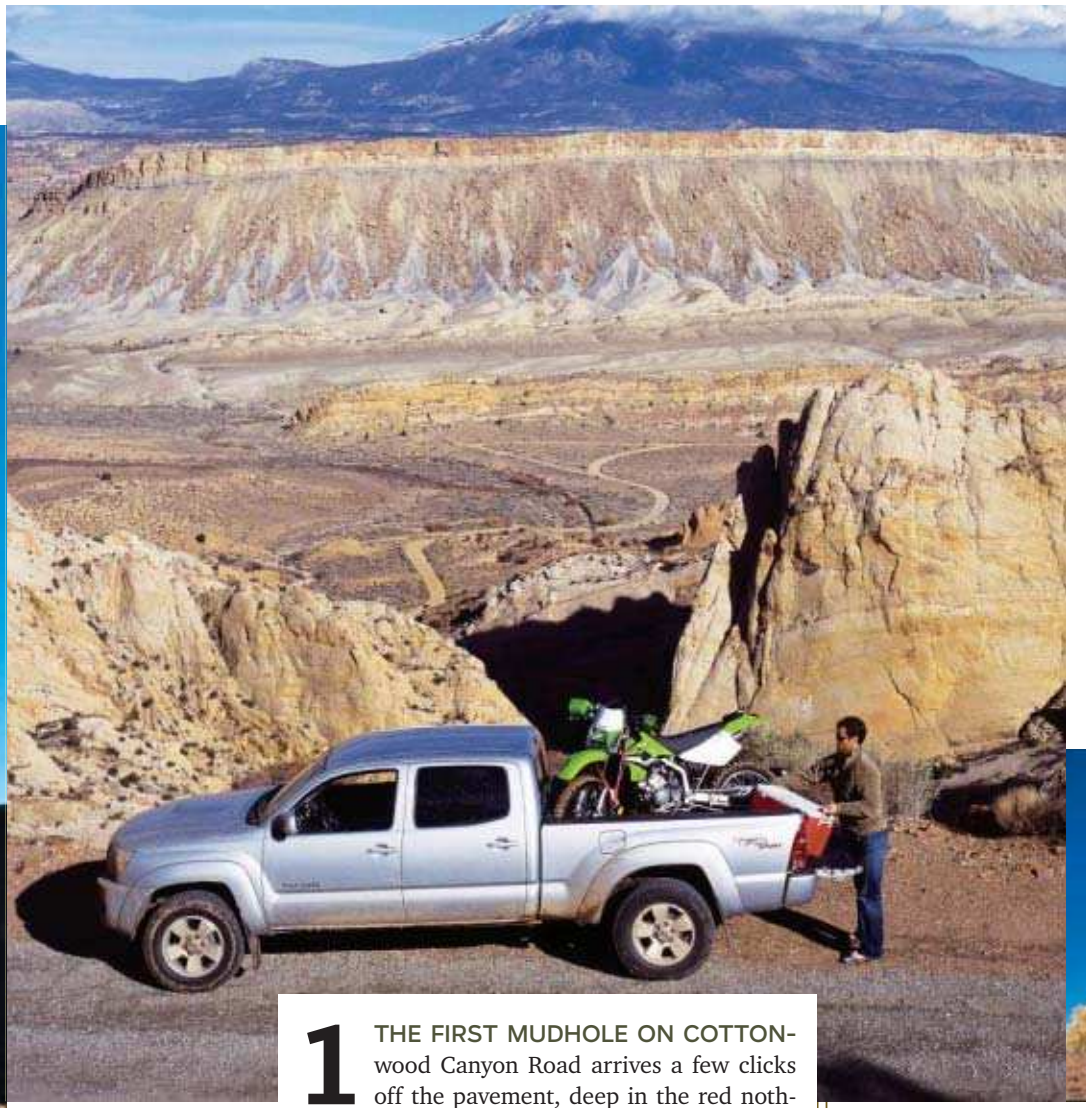
UT/AZ

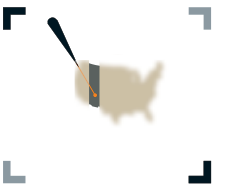
Freewheeling In Canyon Country

Text And Photographs By STEVE CASIMIRO



NEW WHEELS, OLD WEST: In Monument Valley on the Arizona-Utah border, stuntman Matt Cronin takes a break on the tailgate of a Toyota Tacoma during a road trip and dirt bike fest in the great Southwest.





THE TRIP

DISTANCE
750 mi.

MAPS BY FLYING-CHILLI.COM

1 THE FIRST MUDHOLE ON COTTONwood Canyon Road arrives a few clicks off the pavement, deep in the red nothingness that is southern Utah. A drenching storm passed through recently and the 47-mile dirt track is a greasy slip-and-slide. If we find ourselves stuck or otherwise screwed, help is 30 miles away.

To make sure we drive out the other side, we shift our tough, new Toyota Tacoma into Low range, lock the rear diff and inch the truck forward into the mud. When we summon all 282 lb.-ft. of torque, there's a machine gun spray of slurry that blankets the hood and windshield, but the Tacoma goes amphibious in a mess up to the rims without a flinch. Engine steaming, quarter panels dripping, the truck settles nicely into submerged twin tracks, ripples shimmering in our wake, until we reach the far shore, 25 ft. later. We mark the location on the GPS and keep aiming north, where the most beautiful road you've never driven lies within a corner of a map you've never seen.

Matt Cronin, a movie stuntman from New Zealand, and I are at the beginning of a four-day road trip—two guys, two dirt bikes and one new truck, cruising through southern Utah and northern Arizona, marking highlights and hazards as we go on our GPS. It's Matt's first trip here, but my fourth of the year. First, I came for the scenery, and then for mountain biking and other outdoor recreation. After a dozen trips, though, what's really hooked me are the ruins, the rock art and the other reminders of the Anasazi who lived here for five centuries, then suddenly, mysteriously, disappeared 700 years ago.

STEEP SHOULDER: Southern Utah's Burr Trail switchbacks 1000 ft. down the Waterpocket Fold, a 100-mile-long escarpment. State-straddling Monument Valley (above).

The new Tacoma seems the perfect match for a desert road trip, providing Toyota comfort finessed into a package that's longer, wider and roomier than previous models. Although we could have used a longer bed to accommodate our Kawasaki dirt bikes (the Tacoma's 73.5 in. was a squeeze), we appreciate the tough composite bed, which obviates a liner. The Double Cab's rear seat handles two adults in reasonable fashion—or, in our case, a mountain of gear.

Still locked in Low range, we twist our way out of Cottonwood Canyon via a gunsight passage known as Cads Crotch and reach pavement

on Utah's Route 12. We boot it 35 miles northeastward across the sage-covered Kaiparowits Plateau in the umber light of sunset and make it to the town of Escalante in time to be the last and sole diners at Escalante Outfitters.

We crash at the two-story, red-brick Prospector Inn and get an early start on a big day of driving by pointing the mud-splattered grille east. Route 12 climbs into the rising sun and crests a plateau that reveals the varied Escalante River drainage at its finest: golden plains to the southeast; a maze of yellow sandstone to the east; and, to the north, the scruffy shoulder of gently tilted Boulder Mountain.

For the rest of the day we alternate highway cruising and dirt-road ripping on the Kawasakis. An hour of driving east from Boulder on the Burr Trail brings us to the Waterpocket Fold, a massive bend in the sandstone that opens just enough to allow the road to drop 1000 ft. in just over a mile. The Tacoma's steering, suspension and traction feel more ballroom than mosh pit, but the truck handles every switchback the Burr throws at it. By nightfall, we've crossed hundreds of miles of spectacular sandstone en route to the town of Bluff in the southeastern corner of Utah.

After a night at the Desert Rose Inn, we rise in the dark and head south across the Arizona line to greet the sunrise in Monument Valley, the most iconic of all western landscapes. The Tacoma hammers across the red dirt road like Ivan Stewart's Trophy Truck in the Baja 1000. Pebbles thwack the mud flaps and a boil of dust rooster-tails behind us as we let our visions wash over the rust red mesas and throbbing blue sky. At this hour—we're the day's first visitors to the Navajo tribal park—the road is empty, and we can take in the Mittens, the Totem Pole and Rain God Mesa without an RV filling the rearview. Under this endless sky, with the road the only sign of humanity, the familiar shapes of these rocks seem to belong to eternity.

We make it back up to Bluff to break our fast at the Dairy Cafe, part of a compound that includes a '50s motel, gas station, Indian jewelry mart and pawnshop. I hold the cafe's aluminum screen door open and invite Matt into an American time warp. There's a woman of indeterminate age guarding the griddle, a swooping Waterpocket Fold of hair atop her creased forehead, spatula held aloft like a club.

Feisty, cranky Faye Belle tells us she has lived in Bluff for 71 years, ever since her daddy moved out from the South. She's the most colorful of the few people we've met on the road. We later learn that she's considered an eccentric and has already placed her headstone in the town's cemetery. It says, "I will always love you." Could it be that beneath her bad jokes and defiant glares beats a sentimental heart?

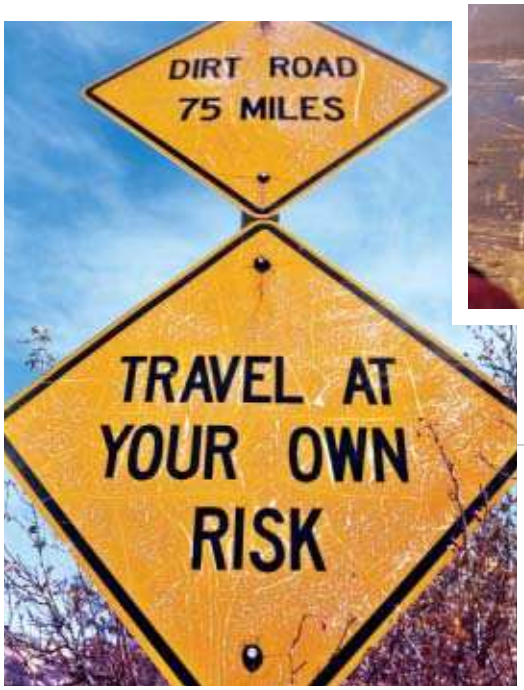
GPS On The Dash

SO LONG, PAPER MAPS. Hello, portable GPS-based navigation systems. We tested three; here's how they stacked up.

TOM TOM GO ***($999; www.tomtom.com)*** ■ **Screen:** Tiny (3.5 in.) and tough to read, especially in glare. Handy location and speed readouts. ■ **Functionality:** Simplest of the three to install and use. Common functions on touchscreen easy to find; hotel and restaurant menus required excavation. Reliable navigation, impressive detail and spot-on road ID.

LOWRANCE iWAY 500C ***($799; www.lowrance.com/iway)*** ■ **Screen:** Biggest in the trio (5 in.) and easiest to read, with 2D and 3D views. ■ **Functionality:** Database contains 2 million points of interest. Voice prompts were very useful, alerting us to upcoming highway exits and telling us which side of the street our destination was on. Best map data interface.

GARMIN STREET PILOT 2620 ***($1517; www.garmin.com)*** ■ **Screen:** Smallest (3.3 x 1.7 in.); difficult to read. Display and menus look dated. ■ **Functionality:** Excellent mapping and points-of-interest menus. Only unit with convenient remote. Has the least effective voice navigation.



SOUTHWEST SIGNS: Pictographs near Bluff, Utah, include the towering Wolfman Panel, at center. Fair warning to Burr Trail drivers, west of Boulder, Utah (left).

DO DROP IN: A Bluff, Utah, dining and social institution since the 1950s.

On The Road To Better Mileage

USE LESS FUEL ON VACATION by following a few well-worn—but still valid—axioms: Easy on the throttle; time your merges; minimize starts and stops; keep a steady speed on the highway (cruise control helps); and keep your wheels aligned. Here are some more tips:

- **TUNE YOUR ENGINE TO THE MAX:** Clogged air filters can kill fuel economy by 10 percent, a bad O_2 sensor by 40.
- **KEEP TIRES PROPERLY INFLATED:** Fuel economy drops 0.4 percent for every 1 psi below specs; check pressure in trailer and spare tires.
- **DON'T TAKE WHAT YOU DON'T NEED:** Pack sensibly and try to keep all your gear inside the vehicle. Each extra 100 pounds of stuff reduces fuel economy by 1 to 2 percent. Towing a trailer can reduce your mpg by up to 20 percent.
- **THINK AERODYNAMICALLY:** If you must resort to a roof rack, use an enclosed carrier to reduce drag. A tall, badly designed rack takes about 5 percent off your mpg.
- **FREEWHEELIN':** When you don't need 4wd, be sure the front wheels, axles and driveshaft are disengaged.
- **SLOW BUT STEADY:** When you are driving off-road, use a light throttle and don't spin the wheels. And shift out of Low range as soon as practical into High.

"You ate *where*?" says Vaughn Hadenfeldt when we meet him after breakfast. Hadenfeldt, respected owner of Far Out Expeditions, part-time archeologist and Anasazi expert, is with climbing photographer Greg Child, who's visiting from Moab. These two have been sniffing after a rumor of an intact kiva, an Anasazi ceremonial chamber. Despite generations of artifact hunters, the terrain is so rugged and complex, the secrets buried so deep, that there are mysteries still in canyon country.

Hadenfeldt wants to show us some rock art, so we drive to an unmarked site along the San Juan River and park. We have blazed across southern Utah, but now at last we move slowly, out of the truck and on foot, thrashing through underbrush at the base of a 30-ft. cliff. There are modern pictographs, painted figures of horses, as well as petroglyphs centuries old. Then Hadenfeldt grabs a big branch and points high on the rock face.

"Look at this," he says, outlining a figure so deeply weathered it is barely distinguishable on the sandstone. It's very clearly a mammoth, and mammoths have been extinct for more than 10,000 years. "Some people," he says, "think this could be the oldest rock art in North America."

The next morning, we visit the Edge of the Cedars museum, 30 minutes north in Blanding. It's filled with artifacts—intact baskets, pots that glisten and gleam, even a long-dead hunter's twisted juniper-bark toolkit with arrow points, feathers for fletching and sinew for hafting. As we drift toward the door, I note that many artifacts were discovered not by archeologists but by hikers, just regular folk. It doesn't take anything special to make these discoveries—just a keen eye, an adventurous bent, and good fortune.

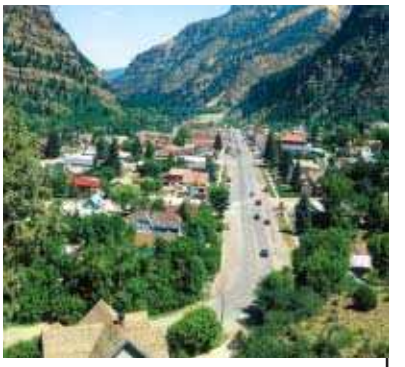
The Tacoma outlegs another storm on the drive back south through Monument Valley en route to Comb Ridge, Cedar Mesa and the depths of Lake Powell—spectacular points in a sweeping parabola that will close our circle tour. With our heads full of GPS coordinates for future trips, we ponder Hadenfeldt's persistent quest to find the intact kiva. He sounded a little frustrated, but something in his voice also said he wasn't done looking. When it comes to canyon country, we know just how he feels.

IMMACULATE RECEPTION

XACT'S NEW REGO XTR5 plug-and-play Sirius satellite receiver provides crystal-clear signals in the car, at the beach—everywhere a road trip radio needs to go. It broadcasts to a car stereo with an FM modulator, pulls in 120 channels, records up to 4 hours of programming, and plays MP3s. ***$349; www.xactcommunications.com***

CONTACTS

ESCALANTE OUTFITTERS (435-826-4266); **PROSPECTOR INN**, Escalante (435-826-4653); **DESERT ROSE INN**, Bluff (435-672-2303); **EDGE OF THE CEDARS MUSEUM**, Blanding (435-678-2238)



RUBICON CROSSING: Jeep Rubicons plunge into a mountain river off the San Juan Skyway. Ouray, capital of off-roading Jeeps (above).

LOCATION

Great DRIVES '05

CO

San Juan Skyway

THE TRIP

DISTANCE
233 mi.

2 FROM THE OLD WEST RAIL AND ranch town of Ridgway, a gnarled span of snowcapped peaks perforates the summer sky, and suddenly it hits you: That's why you're driving a Jeep Rubicon, a four-wheel-drive fireplug born to conquer the summits and dark gorges of the San Juan Mountains.

The San Juan Skyway, a legendary two-laner that runs through the range, also leads to prime 4wd real estate. Punching through a narrow valley south of Ridgway, you pull into Ouray, aka the Jeep Capital of the World. Off-road trails snake off in every direction, but the most famous is the Alpine Loop, a ruthless, unpaved coil of dirt tracks through ghost towns, past abandoned mines and over high ridges.

The Rubicon's puncture-resistant tires and optional off-road package of winches, rock rails, and reinforced bumpers with skidplates allow even beginners to tackle the 4wd-only sections of the Alpine Loop, but leave it to the experts to drive the double-black-diamond branch trails like Black Bear Pass.

At Silverton you can unwind at Handlebars Food & Saloon with cream of green chile soup or baby back ribs slathered with the house barbecue sauce. The hardest part of this trip is behind you—the road is paved the rest of the way to Durango. But what a road: Route 550—known as the Million Dollar Highway when it was built (when a million was real money)—winds through majestic Rockies terrain. It's a favorite with RVers and touring motorcyclists. But you'll have something they don't: real off-road dirt splattered on your Jeep. By the time you've closed the Skyway's 233-mile loop in Ridgway, you'll want to tackle it all over again—with more detours. After all, you've got the gear and a few trails under your belt. How tough can Black Bear Pass be? —ERIK SOFGE

OFF-ROAD JACK-OF-ALL-TRADES

Electric winches bail out plenty of off-roaders, but they cost hundreds of dollars. A low-cost alternative that's a favorite among the four-wheeling crowd: the reliable **HI-LIFT JACK 485**, which can be used for tire changes, lifting vehicles off rocky perches, and—in a pinch—as a poor man's hand winch. *$73; www.hi-lift.com*

CONTACTS

HANDLEBARS FOOD & SALOON, Silverton (970-387-5395); **DURANGO 4x4** off-road outfitter, Durango (888-259-8676)

PHOTOGRAPH BY RANKIN HARVEY, HOUSERSTOCK (JEEP RUBICONS AND OURAY)

LOCATION

Great DRIVES '05

CA

Driving The Best Of The West Coast

By BEN STEWART

THE TRIP

DISTANCE
400 mi.

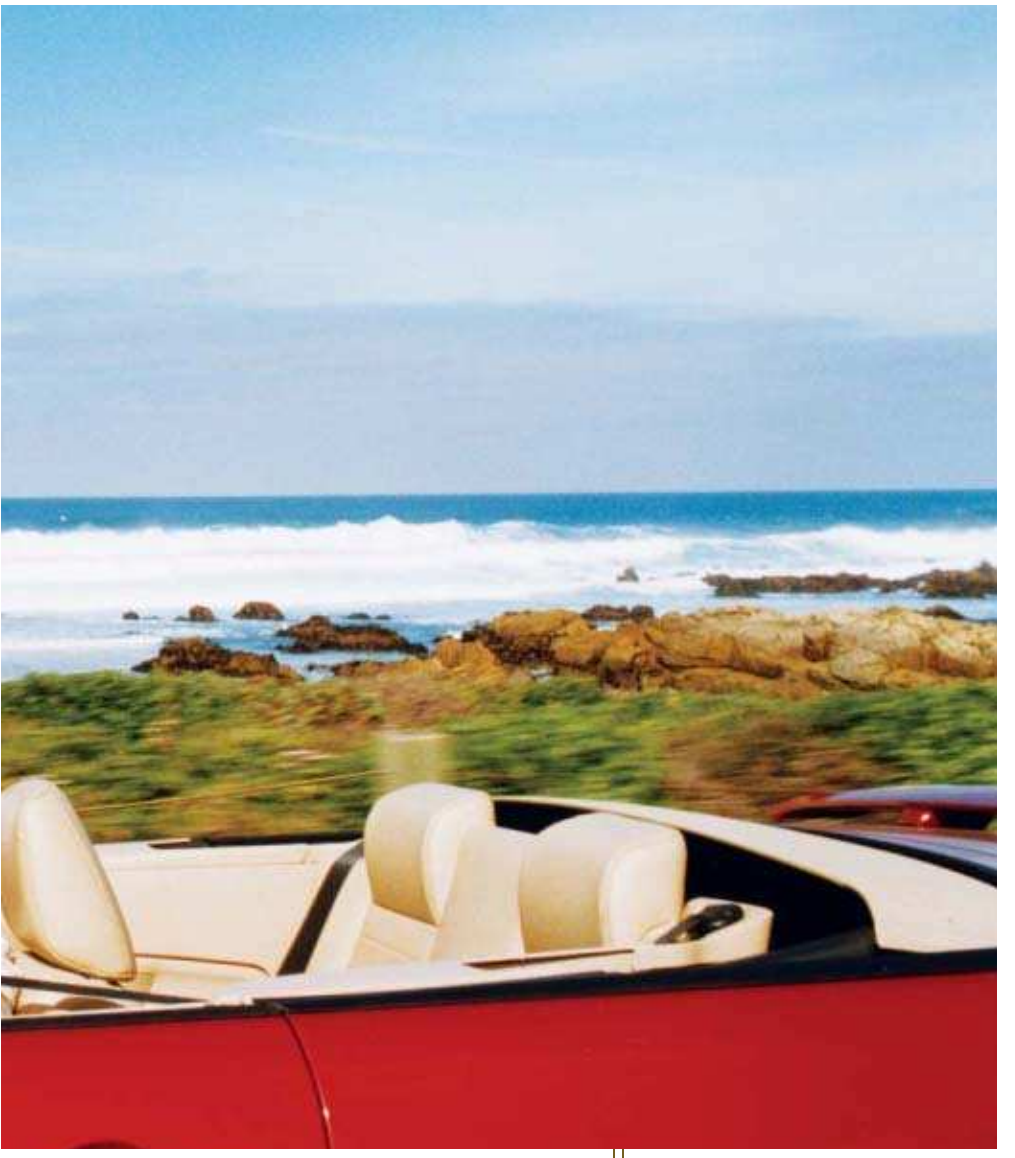
WE'VE GOT THE MUSTANG sideways and scrambling for traction south of Monterey on a stretch of the Pacific Coast Highway that was recently ravaged by rockslides. The old-school solid rear axle hops and skitters around the narrow corners and broken pavement, but I'm in control behind the wheel of Ford's newest convertible ponycar. So I wind the muscular V8 up to the redline and let the cool ocean breeze stroke our cheeks.

The Pacific Coast Highway is a road you take when you love to drive. Since the late 1930s the PCH has inspired travelers to follow an adventurous path along the California coast. For more than 40 years, the Mustang has represented that intrepid spirit, too. The classic American musclecar is the perfect partner for this three-day road trip.

Our freshly minted, 300-hp Mustang GT Convertible was spec'd with just about every

option, including a five-speed manual transmission. (When the roads are challenging, we like to shift for ourselves.) It's also got a Shaker 1000 sound system and cool-looking Torq Thrust-style wheels. My girlfriend and copilot, Ella, doesn't care about the wheels; she's all about the music.

PHOTOGRAPHS BY **JENNIFER ROCHOLL**



When she cranks up a CD of The Thrills, she gives the Shaker 1000 a nod of approval. The whole Mustang experience is like a platinum card to the cool club. This is going to be a fun trip.

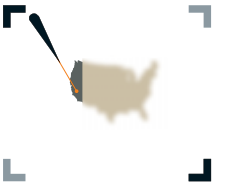
We point the pony's nose north up the Malibu coastline and gallop past craggy mountainsides and sun-soaked beaches. In Oxnard we hit the Vintage Museum of Transportation and Wildlife, established by newspaper tycoon Otis Chandler to house his amazing collection of classic automobiles and motorcycles. Our favorite: a 1907 Harley-Davidson Strap Tank Single, one of only five or six still in existence.

Past Oxnard, the PCH joins Highway 101 to form a stretch of plain-vanilla road that's almost beneath our Mustang's dignity. In Santa Barbara we exit onto Route 154 and head northwest

BEACH PATROL: Puttering along the 17-Mile Drive in Pebble Beach at 20 mph, the 2006 Mustang GT gets a taste of salt spray on its three-day gallop up the California coast. (Hey, Ella, buckle that passenger belt!) Left: Farther south in Big Sur country, the pony approaches the 718-ft. span of Bixby Creek Bridge.

UNDER THE GUN

We never recommend driving above the speed limit. But if you do slip up and creep over the line, the **VALENTINE ONE** radar detector may help you avoid a few extra points on your license. It detects Ka-band, X-band, K-band, laser from both front and rear, even the Euro Ku-band. ***$400;*** ***www.valentine1.com***



Auto Play

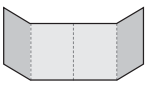
In-car entertainment used to mean cassette tapes stuffed in the glovebox and endless games of Punch Buggy with your sister. Today, with enough bucks, you can kit out your car like a rolling Circuit City.

- **ALPINE KCA-420I iPOD INTERFACE:** It pairs any iPod, iPod Photo or iPod Mini with any 2004 and newer Alpine Ai-Net head unit, which means you can browse your library, search for tracks and charge your iPod at the same time. The interface unit also gives digital music a boost for CD-clean sound. ***$100;*** ***www.alpine-usa.com***

- **MYRON & DAVIS:** For the days your Mustang is in the stable and your SUV is on the road. Better make that a *big* SUV. This gigantic 15.4-in. monitor is ceiling mounted; a TV tuner is sold separately. ***$1199;*** ***www.myronanddavis.com***

- **KVH TRACVISION A5:** DVDs are great but wouldn't 125 channels of DIRECTV be even better? This satellite receiver system pipes in signals via a low-profile antenna that attaches to an SUV roof rack or directly to the roof. ***$2295;*** ***www.kvh.com***

TURN PAGE
ROAD TRIP GATEFOLD



Great DRIVES '05

PLUS:
35 More Must-Drive Routes In All 50 States

6 HI Hana Highway 50 mi. HI 36/HI 360 A Triumph Rocket 3 is the perfect way to cruise Maui's eastern shore. The route crosses 54 bridges (many of them single lane) and hits lots of tropical highlights: bamboo groves, a black sand beach, lava tubes of Waianapanapa State Park and a 14th-century lava rock temple near Puaa Kaa.

7 AK Seward Highway 127 mi. AK 1/AK9 It's a compact route that showcases the state's scenic variety: fjords (Turnagain Arm), wetlands (Potter Marsh), wildlife (don't hit any bears), snowy mountains, even drive-past and drive-up glaciers (including one in Kenai Fjords National Park).

8 WA Juan de Fuca Highway 61 mi. SR 112 Weaving between wave-battered sea cliffs and temperate rain forest, this remote highway skirts a fjord from Puget Sound to Cape Flattery at the northwestern tip of the Lower 48. Stop along the way to fish for salmon and halibut in Seiku, and go crabbing and shellfishing at Pillar Point.

9 OR Central Oregon Coast 70 mi. US 101 This route strings together coastal state parks that protect rocky shores, sandy beaches and old-growth forests. To see sand-rail racers in action, head inland to the Umpqua and Horsfall areas in the Oregon Dunes National Recreation Area.

11 ID Northwest Passage Scenic Byway 90 mi. ID 13/US 12 This section of Lewis and Clark's route follows the churning Clearwater River, impressive from the car but even more exciting in a white-water raft launched from Big Eddy. Talk about undaunted courage.

12 MT/WY Rockies Road 429 mi. US 89/US 287/US 20/US 16/US 14 Load up the RV and set out on an epic Northern Rockies drive, from Glacier National Park down to the thermal wonders of Yellowstone, and then mosey east to Cody's outstanding Buffalo Bill Historical Center.

15 SD Black Hills Loop 191 mi. US 14A/US 385/SD 79/I-90 After rumbling through the granite spires and piney woods of the Black Hills on your custom chopper, stop in Deadwood, the Wild West dead end for Wild Bill Hickok and now a casino town. Farther south, buffalo still roam Custer State Park. Before looping back to the Sturgis Motorcycle Rally (August), make the photo-op stop at Mount Rushmore. The boys at the burnout pit will never know.

13 NM Turquoise Trail 100 mi. I-40/NM 14/NM 536
Roar through desert plains and red rock canyons in your Ford F-150 visiting heritage sites, both real (Old Coal Mine Museum in Madrid) and fake (Eaves Movie Ranch near Santa Fe, the setting for many TV and movie Westerns). Then muscle the truck to the top of 10,678-ft. Sandia Crest, where the Rio Grande carves toward Albuquerque.

14 ND Sakakawea Trail 109 mi. ND 200/ND 200A Named after Lewis and Clark's indispensable Shoshone guide, this lightly traveled road winds through a landscape little changed in places since the days of the explorers—windswept prairie, stark mesas, and the Missouri Valley. Among many expedition sites is a reproduction of Fort Mandan, where Lewis and Clark wintered in 1804-05.

16 NE Outlaw Trail 238 mi. NE 12 Though the desperadoes rode off into the sunset a long time ago, Highway 12 still has aces up its sleeve, like Ashfall Fossil Beds State Park, and the Devil's Nest, reputedly a hide-out for the James gang.

17 KS Flint Hills Tour 84 mi. KS 177 From Manhattan, home of KSU, this two-laner heads south past the limestone outcrops and tallgrass prairie of the rolling Flint Hills. One surprise: the 1881 Z-Bar Ranch, a three-story mansion in native stone.

18 OK Talimena Scenic Drive 54 mi. OK 1/AR 88 Motorists make frequent stops at scenic lookouts along the crest of Rich and Winding Stair in the Ouachita Mountains. Horse Thief Springs recalls a 19th-century rustlers' way station.

NV Highway 50 287 mi. NV 50

10
It's the last word in lonesome—Highway 50, where you can crank it up (we won't tell) on a statewide two-laner that crosses basin and range with only a few speed bump outposts along the way.

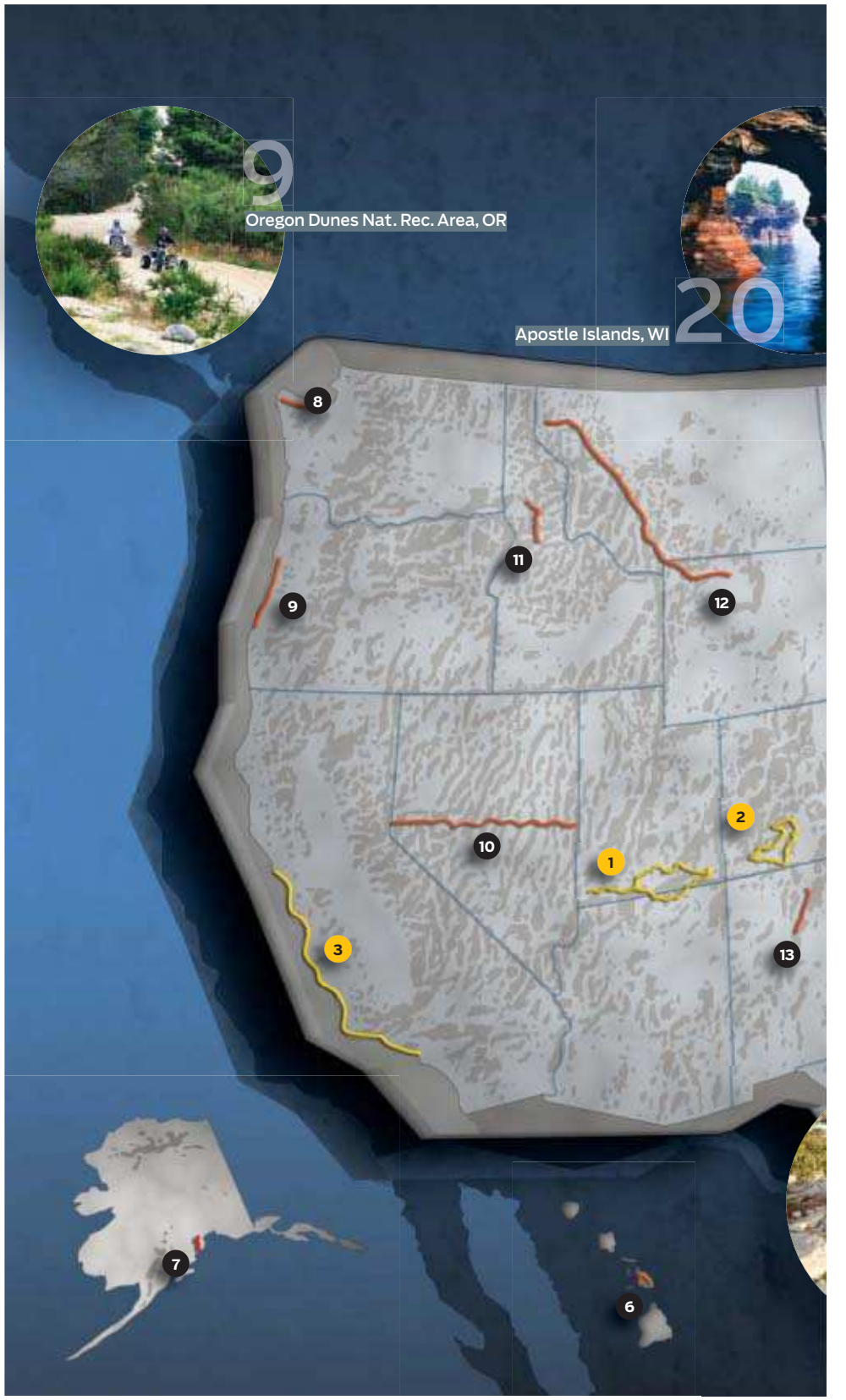
MAP ILLUSTRATION BY **FLYING-CHILLI.COM**

19 TX Independence Trail Sampler 93 mi. TX 239/US 181/I-37/US 281 The complete trail criss-crosses 28 counties, but let's cut to the chase: Begin near the Spanish missions of Goliad. Head northwest, skirting the San Antonio River to stand in the shadow of San Antonio de Valero, the stone mission better known as the Alamo.

20 MN/WI Lake Superior Shore 227 mi. MN 61/I-35/I-535/US 53/WI 13 From the Canadian border, this drive follows Superior's north shore through eight state parks, including Split Rock Lighthouse State Park with its turn-of-the-century beacon. It then continues along the south shore. From Bayfield, boats visit the Apostle Islands, riddled with sea caves and lined with sandy beaches.

21 IA Great River Road 62 mi. IA 76/IA 340/US 18/US 52 With more whiplash curves than Magic Mountain, this bluff-top drive along the Mississippi begins at the ancient Effigy Mounds National Monument. Ascend Pikes Peak for river valley panoramas. Then it's back down through the cornfields and up to tiny Balltown for more great views.

22 AR/MO Ozarks 258 mi. AR 7/US 65/MO 76/US 160/MO 95/FR 147 Head north from the limestone bluffs of Hot Springs into the oak and hickory woodlands of Ozark National Forest. Dogleg east and follow the Glade Top Trail, a two-lane gravel forest road through Missouri's rolling Ozark Plateau.



PHOTOGRAPHS BY NATIONAL GEOGRAPHIC/GETTY IMAGES (MT/WY); JEFF SCHULTZ/ALASKA STOCK (AK); GETTY IMAGES (SD); JON ARNOLD IMAGES/ALAMY (TX); HAUSERSTOCK (OREGON DUNES)

CD GAME PLAN

Portable navigation systems are handy, but **DELORME'S STREET ATLAS USA 2005** lets you load a CD onto your laptop PC and plan your road trips from door to door, complete with fuel stops, great restaurants and reasonably priced hotels. This latest version has 4 million points of interest and GPS capabilities. ***$50; www.delorme.com***

13 Sandia Crest, NM

38 Blue Ridge Parkway, VA/NC

23 **LA Creole Nature Trail** 105 mi. LA 27/LA 384/LA 385

24 **MI Pontiac to Michigan Speedway** 101 mi. M 1/I-94/US 12 Gentlemen, start your engines—and cruise down storied Woodward Avenue in Pontiac, past Henry Ford's Model T plant and the original 1905 Caddy works. Now that you've toured the birthplace of American car culture, head west into the lakes and farmland of the Irish Hills and catch the action during the Indy 400 at the Michigan Speedway in tiny Brooklyn.

25 **IL Lincoln Highway** 179 mi. US 30/IL 31/IL 38/US 52/IL 2/US 30 Follow the original route of the first U.S. transcontinental paved highway, from the muddy banks of ol' Miss in Fulton across rustling cornfields and prairies to the Indiana border. See preserved stretches of the original highway and a rare "X" rail crossing at Rochelle's Railroad Park, then drop in on the Chicagoland Speedway for ARCA/IRL weekend.

PHOTOGRAPHS BY DAVID MUENCH/CORBIS (SANDIA CREST), LARRY ULRICH (APOSTLE ISLANDS), GETTY IMAGES (MI)

SIX-IN-ONE POWER PLANT

Talk about multitasking. The XPOWER POWERPACK 400 PLUS not only generates 400 watts of AC to power all your take-along electric toys, it also doubles as a 250-psi air compressor, emergency light and AM/FM radio. Plus, it comes with a built-in battery and jumper cables so you can use the Xpower to jumpstart your car when you leave the lights on. ***$150; www.xantrex.com***

Put the top down (but bring the bug juice). This horseshoe-shaped drive crosses the Intracoastal Waterway and stops at the Sabine National Wildlife Refuge, where hawks and falcons soar above gator-filled marshes. Down on the Gulf of Mexico, you can surf-cast at Holly Beach, then curve back north past rice paddies. Final stop: Lake Charles, where you can pad over white sand beaches or unleash your inner riverboat gambler in the town's casinos—bolo tie optional.

26 OH/IN Ohio River Scenic Byway 755 mi. OH 7/US 52/US 50/SR 56/SR 62/SR 66/SR 662/I-164/SR 62 This epic drive follows the Ohio River, from wooded ridgetops and valleys to fossil beds and limestone gorges. The country's last river steamboat chuffs out from the Ohio River Museum in Marietta, Ohio. Native American sites along the route date back 700 years.

27 KY Cumberland Gap to Cumberland Falls 86 mi. US 25 Begin at the beginning—the towering bluffs and limestone caves of Cumberland Gap National Park, where Daniel Boone breached the Appalachians. Pinnacle Peak offers stunning views of three states. If you're at Cumberland Falls State Resort during a full moon, look for rare moonbows arcing over the cataract.

28 MS/AL/TN Natchez Trace Parkway 429 mi. A frontier link between the Mississippi River and the Tennessee Valley, the Trace sets out from Mississippi bottomland (detour to the Casey Jones Museum State Park to glimpse early railroad life). It crosses Alabama cotton fields and Tennessee forests before opening up in gentle farmland, which will help you forget that the route was once called "The Devil's Backbone."

29 AL Talladega Scenic Drive 27 mi. AL 281 This short but sweet drive through the Talladega National Forest tracks the southernmost Appalachians and the largely unspoiled Cheaha Wilderness. At pavement's end, off-roaders with 4wd set off on the dirt road at the Pinhoti Trailhead.

ME Maine Coast 158 mi. US 1/ME 3/ME 102/ME 233 A drive up Maine's fretted shore takes in tidy villages and harbors filled with sailboats. Don't miss the antique car and airplane shows at the Transportation Museum in Owl's Head.

30

PHOTOGRAPHS BY RICHARD A. COOKE/CORBIS (PA/WV). MIRA/ALAMY (NY). AP (SC). TONY ARRUZA/CORBIS (BLUE RIDGE PARKWAY)

31 NH White Mountain Trail/Kancamagus Scenic Byway 100 mi. US 302/US 3/NH 112 It loops through a checklist of New England sights: the Frankenstein wooden train trestle in Crawford Notch; Bretton Woods; a short detour to earn the "I Climbed Mount Washington" bumper sticker; Flume Gorge; and Clark's Trading Post. One highlight is no more: The Old Man of the Mountains, which finally tumbled into Franconia Notch.

35 NJ Delaware Valley 30 mi. NJ 29 This short but fascinating trek along the Delaware winds upstream through quaint river towns to the site of Washington's crossing. Enough quaint? Hit Bull's Island for canoeing and cycling.

36

PA/WV: Laurel Highlands to Cheat River 111 mi. PA 711/PA 381/WV 26/WV 72 Bike through the mixed hardwoods of Forbes State Forest or tour Frank Lloyd Wright's Fallingwater, then press on to historic Fort Necessity. The route snakes toward Tray Run Viaduct, a crucial Civil War railway that spans a canyon on 58-ft.-high arches.

37 MD/DE Surf to Turf 72 mi. US 301/US 50/MD 404/MD 313/MD 311/DE 8 If you have a boat, bring it: from Annapolis, the route soars high above the Chesapeake to the Eastern Shore, where it meets a trio of bayside state parks.

32 RI/MA New England Sampler 121 mi. RI 77/US 6/RT 25/MA 6A/US 6

It's a slo-mo summer classic: cruising up Rhode Island Sound in a convertible, stopping at roadside stands, wandering through colonial ports, then logging serious Cape Cod beach time.

33 CT Litchfield Hills 87 mi. US 202/US 7/US 44/CT 63/CT 109/CT 47/CT 45/CT 341/CT 8 Ramble from Litchfield's village green to the Bantam River for canoeing and fishing—then follow rolling countryside to the Connecticut Wine Trail.

34 NY Lake to Locks 200 mi. US 4/NY 22 This scenic upstate run between Lake Champlain and the Adirondacks is steeped in Revolutionary War history, from the commons at Fort Ticonderoga to Saratoga, site of the 154.5-ft. Saratoga Monument.

38 NC/VA Blue Ridge Parkway 469 mi. Fire up the cruiser bike and lean into the curves on this Appalachian classic. Between eye-goggling views, check out the birthplace of the mechanical reaper (Cyrus McCormick's Farm) and the world's largest collection of antique American motorcycles and cars (Wheels Through Time Museum).

39 SC Cherokee Foothills 130 mi. SC 11 From the Peachoid sculpture in Gaffney, wander east past Table Rock Mountain and Revolutionary War battlefields, with Glassy Mountain's sheer granite face standing silent sentry.

40 GA Sea Islands 81 mi. GA 520/GA 99/US 17T You'd need an amphibious vehicle to fully explore the marshes and cypress swamps of the "Golden Isles." But on higher ground you can see how the other half lived in the Old South (Butler Island Plantation), the Gilded Age (palatial Jekyll Island "cottages") and the present day (fancy golf resorts and gracious Savannah homes).

TURN BACK
ROAD TRIP GATEFOLD

DOCK OF THE BAY: Monterey's sardine-fueled Cannery Row era is long gone but trawlers still ply the bay for salmon, albacore and halibut. Below: Fueling up for the road trip at a midcoast burger joint.

on the twisty two-laner over San Marcos Pass and down into vineyard-terraced Santa Ynez Valley, which looks like European countryside transplanted to Southern California.

After a tasting at the Foxen Vineyard, near Los Olivos, we rejoin the PCH in Gaudaloupe and put the hammer down to Pismo State Beach. With a 4x4 you can head inland to explore miles of dunes. In fading light we stick to the hard-packed shoreline and watch dolphins play in the surf. It's nightfall by the time we crash at the Inn at Morro Bay.

The next morning we swing past Morro Rock, an offshore sentinel jutting 576 ft. above the waves, and then head up the coast, pausing at San Simeon to marvel at the extravagance of Hearst Castle before rolling up the PCH's most spectacular stretch, which culminates in Big Sur. It took two decades to carve the highway into these magnificent headlands. The crowning achievement is 718-ft. Bixby Creek Bridge, which soars 260 ft. above the surf. We get lucky and cross this amazing span just as the sun sets.

We spend the night at the Spindrift Inn in Monterey. Once a thriving fishing port, Monterey now survives mostly on tourists visiting the aquarium and Fisherman's Wharf, but we can't drive through town and pass up the chance to cruise top-down through 17-mile Drive and the Del Monte Forest in Pebble Beach. It's been a signature California coastline drive since the 1800s, but we've also got something special waiting for us up the road—Mazda Raceway Laguna Seca.

Thanks to our friends at the Skip Barber Racing School, we take a few laps around the famed track during the lunch break. The Corkscrew section of the 2.24-mile track has given even motor racing's finest drivers the pucker factor, so we keep our speeds down. Still, the sound of the exhaust wailing off the hillsides reminds us of legendary racer Parnelli Jones who won a Trans-Am race at this very track in a Boss 302 Mustang 35 years ago.

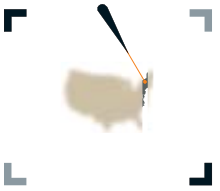
We pick up Highway 68 back to the coast and press on up the coast to wet, gray San Francisco. Across the Golden Gate Bridge, we take the first exit and wind up Conzelman Road for a look back at the steel span, lit up for the evening commute. Even though we've spent three long days behind the wheel of the Mustang, we don't want the adventure to end. Los Angeles is only 400 miles away. We're not tired. And the Mustang has a full tank. We could make it by midnight if we hustle. Ella looks at me wild-eyed. "Let's hit it!"

LOOK, MA—NO HANDS!

Bluetooth is becoming the standard for hands-free mobile phones. The **WIFI SONY ERICSSON HCB-300** can identify up to five different cellphone users, assigning colors to each on a monitor. When a phone rings, the HCB-300 mutes the radio or stereo, then broadcasts the call over the car's speakers. ***$200; www.sonvericsson.com***

CONTACTS

VINTAGE MUSEUM, Oxnard (www.chandlerwheels.com); **FOXEN VINEYARD**, Santa Maria (805-937-4251); **INN AT MORRO BAY** (800-321-9566); **SPINDRIFT INN**, Monterey (831-646-8900)



LOCATION

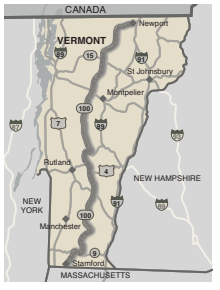
Great DRIVES '05

VT

SHUNPIKE: Route 100 winds through a valley near Stockbridge, at the midpoint of the state.

Green Mountain Main Street

THE TRIP



DISTANCE
210 mi.

4 WINDING THROUGH VALLEYS and foothills of the Green Mountains, Route 100 spans nearly the length of the state, from the Massachusetts border to just south of Quebec. Along the way it links classic New England villages, mountain resorts, parks and national forest. Outdoors-minded motorists find plenty of options for fishing, biking and hiking, given the number of rivers and trails that intersect the two-lane route. But choice can be nice, when you have the ability. Hence, you take to the road in a Subaru Impreza Outback Sport. Like every Subaru, the spunky Sport has all-wheel drive that can take you to places that other folks have to walk to. And given the little wagon's folding rear seat and adaptable roof rack, it can handle all the gear inside and atop that you might need. No wonder Vermonters have come to love most things named Subaru. But the Sport's forte is straddling the line between all-weather workhorse and sporty, day-tripping family wagon.

The first stop for anglers driving south to north is Harriman Reservoir in Green Mountain National Forest, stocked with chain pickerel and other panfish. No luck? Then try the salmon at Wilmington's Old Red Mill Inn. Pico Peak, north of Killington, is worth a detour on Route 4. Park at the Inn at Long Trail, then hike south on the Long Trail to a steep spur up to the 3957-ft. summit for views of nearby Mount Killington breaching a sea of wooded hills.

Back on Route 100, the eight-room Wilder Farm Inn in Waitsfield is the perfect place to recuperate. You can jump in the swimming hole on the three-acre grounds or wet a fly-fishing line on the Mad River. Then, after kayaking the Winooski River near Waterbury, treat yourself to the Ben & Jerry's Factory Tour, pre-empting the question everyone gets following a trip through Vermont. Yes, I went to Ben & Jerry's. And, yes, it was better.

Over the covered bridge past Stowe and then northeast toward Newport, the drive descends into dairy lands. A final Green Mountain flourish—3861-ft. Jay Peak, to the northwest—seems to beckon the Subaru to turn around and head back to the high country. —E.S.

FAMILY VALUES ROAD TRIP

Your wagon has enough room for a week's worth of road trip gear or your family, but not both. Dodge a tough decision with Thule's **675B EVOLUTION 2100 BOX**, which adds another 21 cu. ft. of hauling capacity—the equivalent of 12 pairs of skis or two preteens and a beagle. ***$560; www.thuleracks.com***

CONTACTS

OLD RED MILL INN, Wilmington (802-464-3700); **WILDER FARM INN**, Waitsfield (802-496-9935); **BEN & JERRY'S FACTORY**, Waterbury (866-258-6877)

PHOTOGRAPH BY CHROMO SOHM INC./CORBIS (TOP)

LOCATION

Great DRIVES '05

FL

Sunset Cruise

5 THE CORVETTE is a car to show off in. And showing off is a way of life in Miami's South Beach. But our 2005 Vette convertible is so new to the market that it's still a rarity—even here in the land of the chromed-to-the-hilt Escalade. This town is bling overload. No less than four Ferraris are parked in front of the chic Delano Hotel. But the Delano's trendiest patrons still crane to see our C6 ragtop. Even here, this is a hot car. Leaving Miami for Key West is an easy call, especially when you're cruising in a gleaming two-seater roadster. If you're determined to waste away—or just waste a weekend—in Margaritaville, you might as well get there in style.

Pulling out of Miami, you can see white sails inching across glittering Biscayne Bay before U.S. 1 swings inland to skirt the southern tip of the Everglades. This is the time to stop, stow the roof and let the car's cockpit reach for the horizons. The view along the razor-thin isthmus hits you like a hurricane gust: You've reached the edge of the world, where sky and sea overlap.

Stop for some blackened grouper at the quirky Fish House on Key Largo, then watch the reef life through a glass-bottom boat at nearby John Pennekamp Coral Reef State Park. Back in the Vette, pushing south, the Keys begin to shrink and the viaducts grow longer, as you spend increasingly more time soaring across glassy expanses of ocean (the Seven Mile Bridge, south of Marathon, is particularly surreal). Don't expect to stretch your Vette's legs here: With only two lanes for more than 100 miles, someone's bound to back things up.

Once you reach Key West, breeze through the requisite sights—the Southernmost Point in the U.S. (nothing much to see, but there, you've done it) and a self-guided tour of Hemingway's "favorite" bar (pretty much all of them in town). Then grab a table on the outdoor deck of the Turtle Kraals Historic Waterfront Restaurant and Bar on Front Street. As camera flashes flare along the tourist-jammed boardwalk below, you can track the sun's blazing descent and await the inevitable—another piña colada, thanks, and keep 'em coming. —E.S.

KEY MOVE: Top down, sun down, open road ahead, a C6 Vette island-hops to Key West.

THE TRIP

DISTANCE
158 mi.

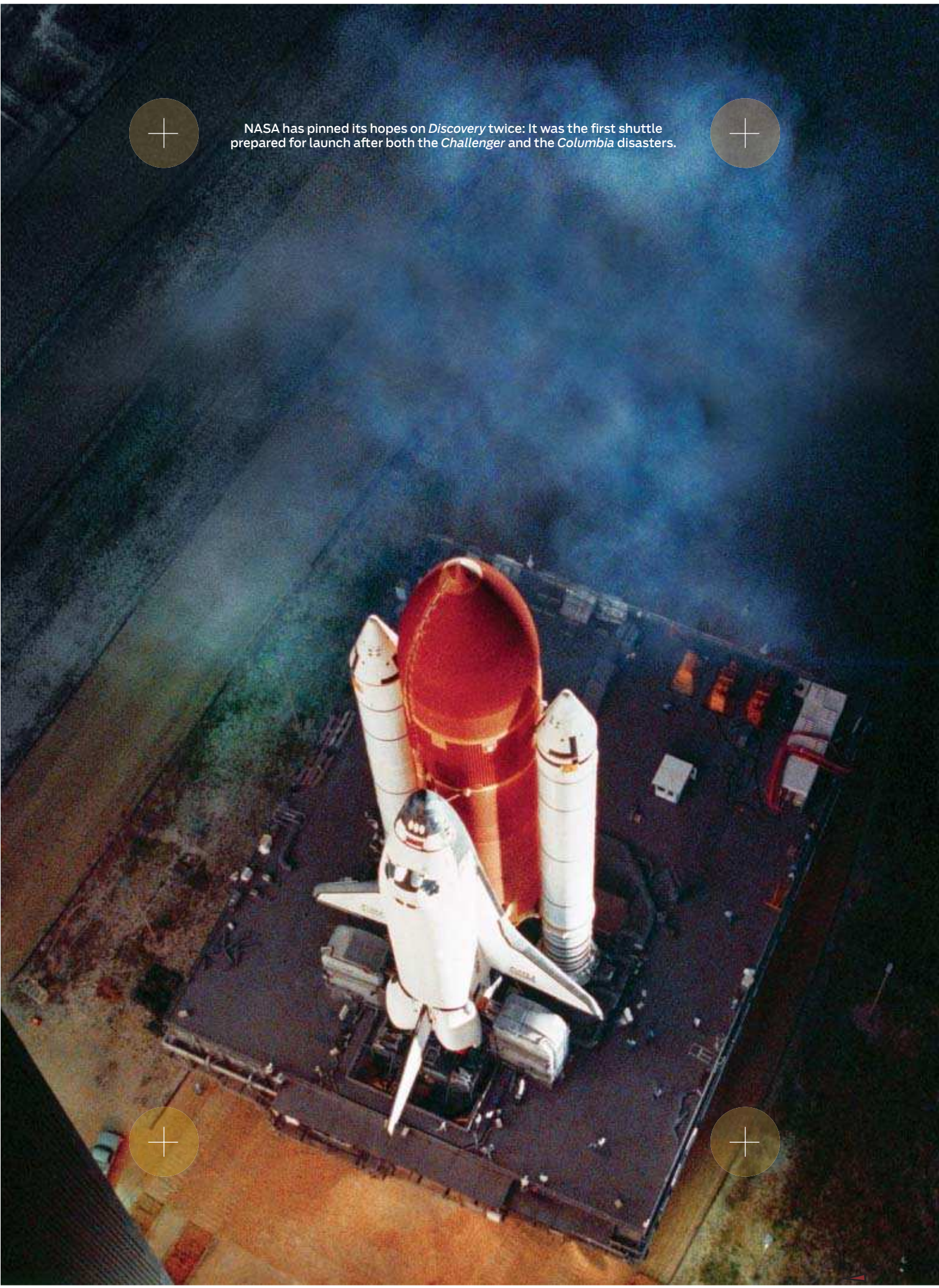
COLD COMFORTS OF THE ROAD

Ice is nice on a subtropical trip, so bring along the 46-pound **ARB REFRIGERATOR**, which plugs into a cigarette lighter and has a 33-quart capacity. You also can plug the traveling fridge into a wall socket at the motel. ***$915; www.arbusa.com***

CONTACTS

FISH HOUSE, Key Largo (888-451-4665); **JOHN PENNEKAMP CORAL REEF STATE PARK**, Key Largo (305-451-1202); **TURTLE KRAALS RESTAURANT AND BAR**, Key West (305-294-2640)

PHOTOGRAPH BY **CHRIS TROTMAN**



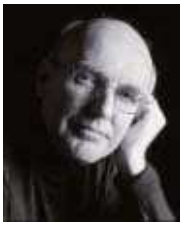
NASA has pinned its hopes on *Discovery* twice: It was the first shuttle prepared for launch after both the *Challenger* and the *Columbia* disasters.

THE GREAT SHUTTLE DEBATE

As NASA rebounds from the ***Columbia*** disaster with the launch of a refurbished ***Discovery,*** an old dispute gains new life. The shuttle is slated for retirement in 2010. But is it worth the risk to keep it flying until then? PM asks two experts for their take.

Retire It Now

Alex Roland
Professor of history, Duke University, and former NASA historian



THE SHUTTLE HAS COST MORE THAN IT IS WORTH from the very beginning. None of the things that it can theoretically be used for—as a mobile laboratory for pharmaceuticals, for instance, or as an experimental site for manufacturing—has economic viability. One of the great tragedies of the *Columbia* disaster was that it had no mission. NASA just flew it for the sake of flying it. The agency thinks that it has to be constantly operating the shuttle and doing cool stuff or public and congressional support will wither. But the risk the shuttle poses to astronauts is simply unacceptable: one death for every eight flights.

An initial selling point was that as a reusable spacecraft the shuttle would cost less to launch than expendable ones. This claim has proved untrue. It's the world's most sophisticated launch vehicle, but it is ruinously expensive. In 1971, NASA predicted shuttle development costs would be $5.2 billion. The Congressional Budget Office reported that by the time the shuttle was declared operational in 1982, $19.5 billion had been spent—an overrun of 375 percent. NASA also predicted that the shuttle would cost $10.5 million per flight. It admits now to spending almost half a billion dollars per flight. Even allowing for inflation, NASA's projections were off by an order of magnitude.

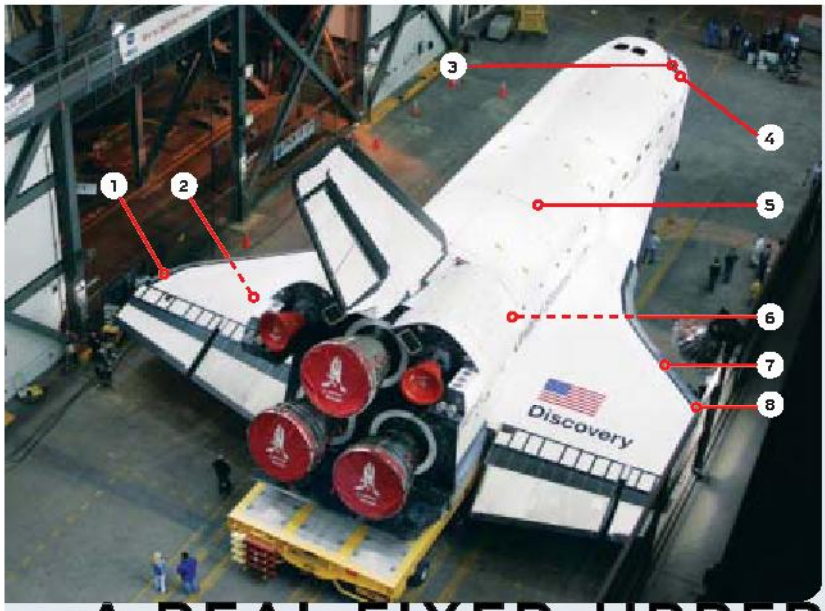
Despite the expense, the shuttle has always flown with engineering problems. NASA identifies technical problems in advance of every launch. (These observations could be compared to someone's car engine light coming on, which sometimes means something serious, and other times does not.) The agency also keeps track of components that have the potential for catastrophic failure, and labels these "Criticality 1." At the time of the *Challenger* accident, NASA waived more than 800 Criticality 1 risks—including the questionable performance of O-ring seals that led to the shuttle's explosion. After the investigation, there was a great infusion of funds and the agency improved the safety systems. But by the time *Columbia* exploded, the number of Criticality 1 waivers had doubled. NASA simply couldn't afford to fix the problems that, by its own criteria, were potentially disastrous.

All of these problems grow worse as the shuttle fleet ages. Expendable launch vehicles keep getting better; engineers learn from each previous version and advance future designs. Because shuttles are enormously complicated and expensive to continually fix, they become less efficient to launch. Even with improvements, such as the changes made to external tanks and to the insulating foam, the spacecraft pose a risk to the lives on board.

Instead of addressing hard engineering, safety and economic realities, NASA has just bulled ahead with the shuttle program. It has a vision, dating back to the Apollo era, of getting to Mars. I think NASA feels that reaching Mars is of such overwhelming historical significance that it must persevere, no matter what the obstacles. We're now presumably operating under President George W. Bush's mandate, announced in January 2004, to complete the International Space Station, retire the shuttle in 2010, develop a new launch vehicle, and then fly that to the moon and Mars. Since we would use the moon as a launching platform for the Mars mission, it would appear the only reason we're flying the shuttle now is to complete the space station. But it is of no use except as a safe haven for the shuttle's crew. It's a circular argument.

If NASA will not abandon the space station, there is an alternative to manned shuttle flights. A compromise would be to send people up on Russian spacecraft. NASA could engineer an unmanned shuttle to fly cargo to the station, and have the astronauts meet the components there for installation. It would be much cheaper since the shuttle wouldn't have to be made safe enough for human passengers. Russia has charged two civilians $20 million apiece to go up in its spacecraft—a piddling amount when a manned shuttle launch costs half a billion.

In any case, we now have light, reliable, smart, automated machines that can do anything in terms of space exploration that humans can do—only better, cheaper and safer. They can travel farther and stay on site longer. Take our small, inexpensive Mars rovers, for example. The two now on Mars are performing way past their predicted expiration date of April 2004. The Viking spacecraft that went to Mars in the 1970s also lasted much longer than expected, and the two Voyager spacecraft launched in 1977



A REAL FIXER-UPPER

NASA spent two years overhauling *Discovery*.

1 **High-Speed Sensors** New sensors at the leading edge of each wing include 22 temperature gauges and 66 accelerometers that pinpoint dings. Each takes 20,000 readings per second.

2 **Tile Overhaul** NASA used to replace about 100 damaged Thermal Protection System tiles after each flight. For *Discovery*, NASA replaced 1900.

3 **Low-Tech Rain Gear** Tyvek replaces butcher paper as the material of choice to rainproof the orbiter's forward Reaction Control System when it is on the launchpad.

4 **Sleek Cockpit** *Discovery*'s new "glass cockpit" has 11 flat-panel displays instead of 32 gauges, electromechanical displays and four cathode-ray-tube displays.

NOT SHOWN
Rethinking The Bipod Foam insulation on the spindles that connect the external tank to the orbiter has been replaced with 5-in. heat coils.

5 **Orbiter Boom** Along the Payload Bay, engineers installed a 50-ft. Orbiter Boom Sensor System with a camera, laser and sensor. The shuttle's robotic arm can wield the device to scan the underside of the orbiter for damage.

6 **Live-Feed Camera** A digital camera in the belly of the orbiter will beam launch imagery to astronauts and then to ground control. Previous cameras used film, which wasn't developed until the shuttle returned to Earth.

7 **RCC Panels** More than 400 sq. ft. of Reinforced Carbon-Carbon panels were removed from the shuttle and blasted with ultrasounds, CT scans and new flash thermography to check for internal flaws.

8 **Sealing Out The Heat** A thermal protection barrier has been added to the carrier panels that bridge seams along the leading edge of the wings. This will prevent hot plasma from penetrating the wing structure in the event of a breach.

—DAVIN COBURN

I think NASA feels that reaching Mars is of such overwhelming historical significance that it must persevere, no matter what the obstacles.

continue to transmit data after nearly three decades.

If we put people on Mars, what could they do there that rovers couldn't? Nothing. The only things humans can do better than machines is smell and taste, and no astronaut is going to smell and taste the Martian atmosphere and soil. Rovers can touch, see and hear better than people can. They can move around with television cameras and look at anything, magnify it, pick it up and retrieve it. Rovers can go anywhere humans direct them to go, and if they fall and damage themselves the worst that has occurred is the loss of a machine.

The real reason behind sending astronauts to Mars is that it's thrilling and exciting. In the 1960s, the concept that humans were needed for this exploration may have been true, but it's now both unrealistic and impractical. I think NASA is in the grips of an ideological agenda.

I am not saying that NASA should abandon manned space flight altogether, but what we've learned from the shuttle is that we desperately need a new launch vehicle that can do what the shuttle was initially supposed to do—that is, dramatically reduce the expense of getting into space. It costs so much to launch the weight of our existing vehicle that taking humans into space is prohibitive. After the *Challenger* accident, it became clear that NASA should not make the shuttle the centerpiece of its launch capability. It's a marvelous vehicle, but it's too costly, too fragile and too dangerous to handle that role.

The *Columbia* accident initiated the largest debris search in history. More than 39 percent, or 84,000 pieces, of the shuttle was recovered.

PHOTOGRAPHS BY CORBIS (PAGE 110), AP WIDE WORLD PHOTO (LEFT), GETTY IMAGES (BELOW)

Keep It Flying

Ken Bowersox
Director, Flight Crew Operations, Johnson Space Center

I WAS ONE OF THE ASTRONAUTS on board the International Space Station (ISS) when the *Columbia* disaster occurred. We were all shaken up. For one thing, we lost our friends. But we also knew the explosion was going to have a serious impact on our program. When something like that happens with a shuttle, you can't expect to turn around and fly again in three months.

I've wanted to be in space from the time I was listening to the radio and heard about John Glenn circling the Earth. *Columbia* was the kind of blow that could have made me walk away from it. As astronauts, though, we wouldn't have been on the space station if we didn't believe in the program. Even after losing our friends and our ride home, we still believed that exploration was important.

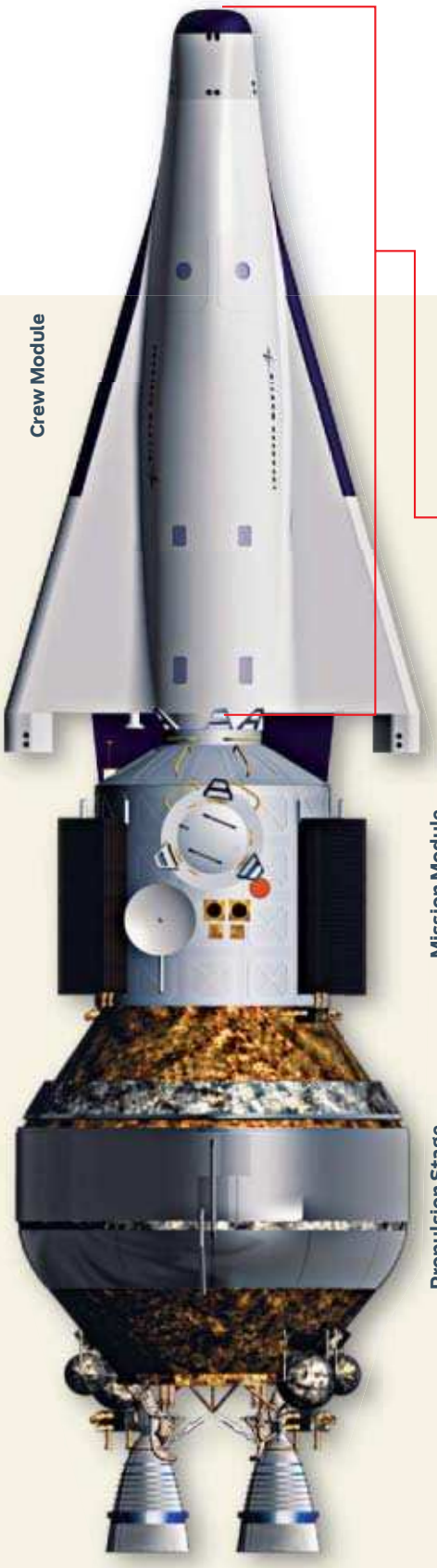
Is the space shuttle both risky and costly? You bet. We will never fly without risk, even though NASA spends a lot of money minimizing it. For months before I board a shuttle, I ask myself, "Why am I really doing this? Is it worth the risk that my children may be without a dad?" And I say yes.

I do so because the process of sending people into flight molds our ability to judge risk. One might liken it to a surgeon with no previous experience operating on a patient: That same surgeon has a better idea how to assess risk after having done multiple surgeries. Well, our engineers and technicians will use the experience they gain

now in the next program. When you take time off, it becomes harder and harder to make these tough decisions. You don't want to just stop cold.

One of the risks we weigh is created by a Criticality 1 part. If it fails, you could lose the vehicle. There are a lot of those parts on the shuttle, and we go through a very rigorous process to identify each one. Then we ask, "Is this something we can actually change, or is this something that we have to accept?" We involve as many people as possible in the discussion, and the process is as important as the outcome.

The mission of the *Discovery* crew is worth pursuing: the completion of the space station. There we can learn



THE FUTURE OF FLIGHT?

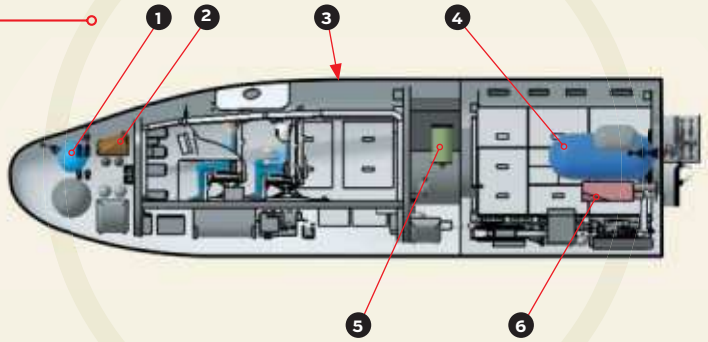
Lockheed Martin unveils its proposed shuttle replacement.

When NASA requested designs for a Crew Exploration Vehicle (CEV), two major teams—one headed by Lockheed Martin and one by Northrop Grumman and Boeing—took on the challenge. The winning concept will be chosen in 2008, and the manned vehicle flown in 2014.

The agency's primary requirement is to "ensure crew safety through all mission phases." The Lockheed team—consisting of six companies—came up with a CEV in three parts. The titanium crew module holds four to six astronauts and launches separately from the mission module and the propulsion stage. They rendezvous in orbit to create a 70-ft.-long vehicle that weighs just under 40 metric tons.

The team scrapped foam insulation in favor of a redundant Thermal Protection System that includes a backed-up carbon-carbon heat shield. In an emergency, a rescue module designed into the top 22 ft. of the crew module can be fired off at any time. The CEV is not designed to glide upon re-entry like the shuttle; rather, it will be equipped with parachutes and airbags to set down on land or water. Interchangeable computer systems will increase adaptability between modules.

The most anticipated—if least glamorous—advancements will include a means to generate power for long-duration stays in space and a diagnostic safety system to troubleshoot problems. Says Pat McKenzie, business development manager for Lockheed's CEV program, "Simply getting to space shouldn't be the exciting part." —D.C.



INSIDE THE CREW MODULE

1. Nitrous-oxide mono-propulsion system
2. Float bags
3. Micro-Meteoroid and Orbital Debris protection shield
4. Liquid oxygen long-term storage
5. Supersonic drogue chutes
6. Fuel cell

how to live in space, how to keep equipment working, and how to provide food, air and water to the crews on board. We're studying how humans change when they go into microgravity as well. One of the experiments I participated in examined the relationship between muscle activity and bone mass loss. If we can understand the mechanism behind losing bone density, it could help us understand diseases like osteoporosis here on Earth.

Internationally, the space station is an important tool for diplomacy. Millions of things in the world pull us apart as nations, and having the space station to hold us together is really valuable. Right now, the shuttle is the only vehicle the United States possesses that can rendezvous with the ISS. Other vehicles could launch the cargo, but it would take quite a bit of research to develop the software for docking. And as for flying with Russia on its spacecraft to complete the station, there's a law that prevents us from spending the amount of money necessary to do so. The Iran Nonproliferation Act of 2000 says we can't send money to the Russian Aviation and Space Agency unless the Russian government can demonstrate that it is not assisting Iran with the development of nuclear technology.

A shuttle flight is risky, but we've done more than ever to make it as safe as it can be. On the external tank, we've removed the bipod ramp foam that came off during the *Columbia* flight and replaced it with electric heaters. Foam on other parts of the tank has been stripped off, and new foam has been applied using processes with a higher level of control. There is also an inner tank area that we believe was particularly subject to nitrogen ice formation. Liquid air would pool at the edge and seep underneath the foam, so we now apply sealant in that area.

Looking in from the outside of the International Space Station—which Bowersox says is a project worth completing.

PHOTOGRAPH BY NASA/PHOTO RESEARCHERS INC. (TOP RIGHT)

People are going to leave Earth someday with regularity, and we as Americans are taking the baby steps now.

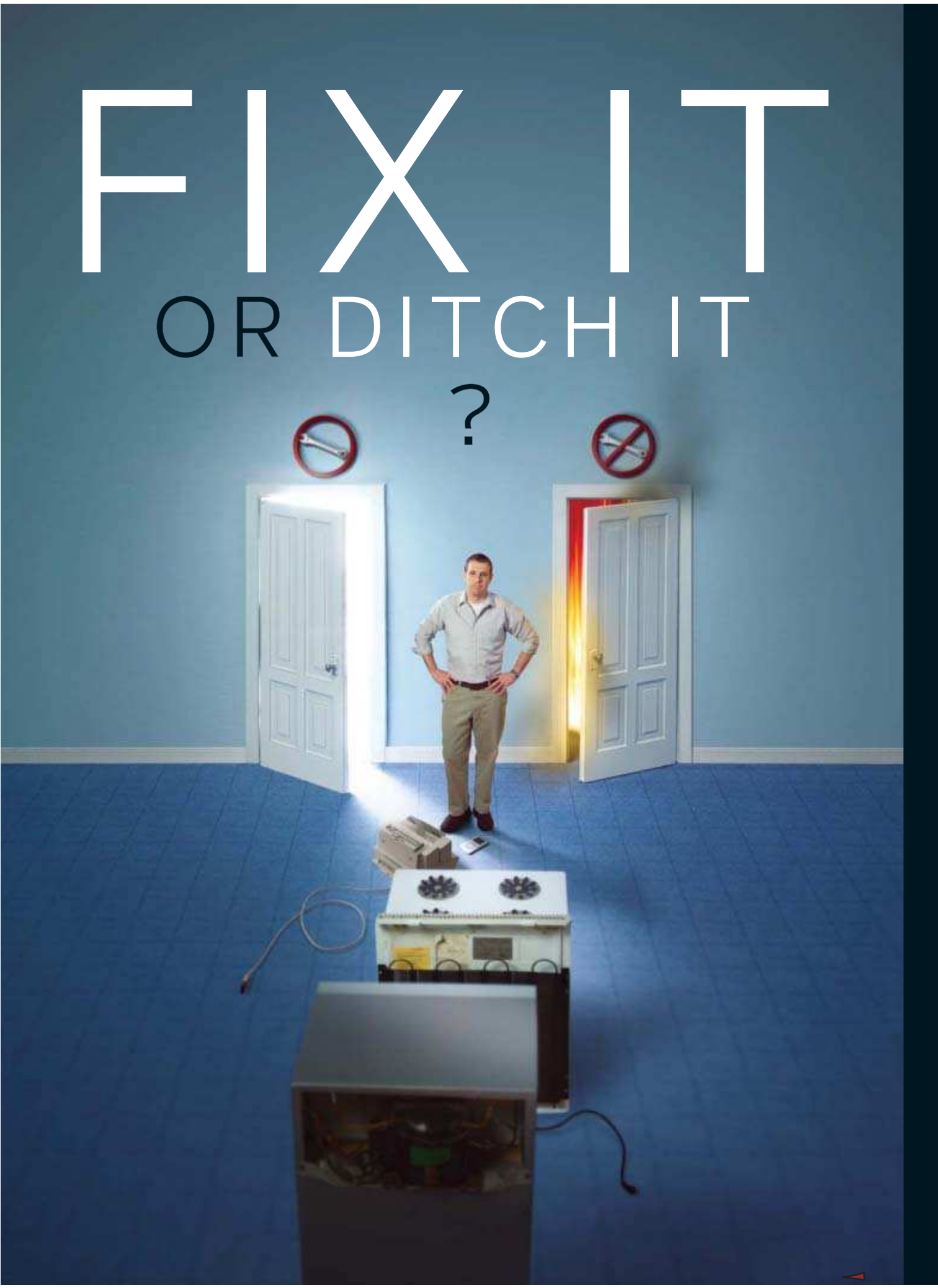
Behind the Reinforced Carbon-Carbon heat panels on the wing, we have placed extra heat-shielding material, and material to block hot gas should one of those breach. There also have been modifications to systems that were not implicated in any previous accident, but which we knew had mechanical issues. For example, we've adjusted the devices on the rudder speed-brake mechanisms, and the flow liners for the propellant lines.

We're trying to dig deeper to find problems and work harder to communicate, too. That may not sound like much, but it's difficult. Breakdowns in communication have led to some of the worst accidents in NASA history: the 1967 fire in the command module of *Apollo 1*, the *Challenger* explosion in 1986 and the *Columbia* tragedy in 2003. When we analyzed those situations, it was frustrating to discover how close we were to catching the problems that caused the disasters. NASA needs to figure out how to move information around in our huge program so that we can make ourselves safer.

Finally, I'd like to add that manned exploration itself is a noble thing. The astronauts—along with the teams that put the vehicles together, build the flight plans and design the missions—help to build a road out into our solar system. People are going to leave Earth someday with regularity, and we as Americans are taking the baby steps now. Mars seems to be the planet most hospitable to life. We don't have to be in a big hurry to get there, but we'll learn a lot in the process.

We want to build a better vehicle for getting our crews into orbit, but launching the shuttle again is worthwhile. It lays the foundation for further exploration. Traveling into the unknown is a deep human desire, and you can't take humans out of that equation. **PM**

FIX IT OR DITCH IT ?



A GUIDE TO MAKING THE TOUGH CALLS

They've served you well, cooking meals, washing clothes, chugging away year after year. But all good things come to an end, so when a loyal household appliance goes on the fritz, a homeowner faces a perplexing quandary. Call a repairman? Fix it? Or, just put the thing out of its misery? Every case is different, but here are rules of thumb for those Saturday morning decisions.

by LOGAN WARD
illustration by C.J. BURTON

Electric Dryer

Age: 7 years
Replacement cost: $500
Size: 7.0-cu.-ft. capacity
Typical Life Expectancy: 14 years

You don't care that the dryer's door is dented. Looks matter less than dry clothing. For years it's been delivering those toasty clothes that feel so good on a winter morning. But now things aren't so hot. Does your dryer deserve another spin?

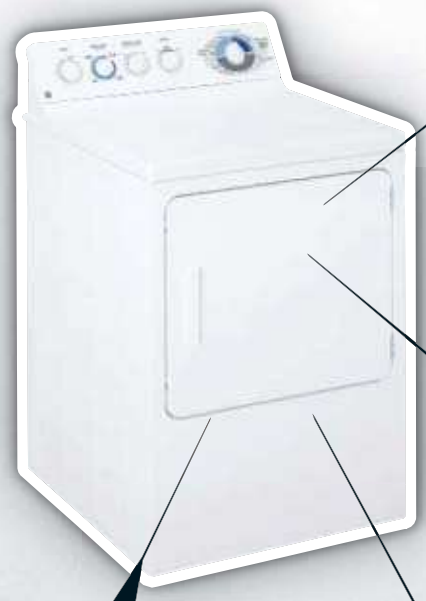
WHY DITCH IT ...

If gas is cheaper than electricity in your region, you might save on utilities by buying a new gas dryer, though you will have the cost of adding a gasline. If you stay with an electric dryer, you still might save if you are swapping out a truly ancient appliance that uses a timer instead of a moisture sensor to end the dry cycle.

WHY FIX IT ...

A compelling fix-it reason is prompted by a change to the National Electrical Code. Electric dryers now use a four-prong instead of a three-prong receptacle. In some cases you might need to upgrade the circuit. That added cost may be reason to stay put.

YOU DO THE MATH ...



GRINDING GLIDES

Grinding/scraping noise while tumbling; damaged clothing
Part: Drum glides, $18
Skill level: Easy, sort of
DIY repair: 30 minutes
Pro repair: $100
FYI: Once you're inside, investigate. Signs of severe wear? Then ditch.

BUSTED BELT

Dryer runs but drum does not turn
Part: Belt, $15
Skill level: Experienced
DIY repair: 30 minutes
Pro repair: $95
FYI: Are you patient? Routing the belt around the idler and motor pulleys is tricky. Check the manufacturer's Web site for a parts diagram.

DEAD MOTOR

Dryer stops mysteriously
Part: Motor, $80 to $115
Skill level: Associate degree
DIY repair: Call a technician
Pro repair: $150 to $200
FYI: Mystery stoppage and a humming sound signal an open motor winding. Remove dryer door to prevent child entrapment. Place dryer at the curb for junk haulers.

THE HEAT IS OFF

Dryer tumbles but no heat
Part: Heating element, $35
Skill level: Intuition helpful
DIY repair: 45 minutes
Pro repair: $135
FYI: Frustration factor: Half the time, element access is from the front, the other half from the back. Unless you know where it is, expect more than 45 minutes of work.

Computer

Age: 5 years
Replacement cost: $500
Size: 17-in. midsize tower
Typical life expectancy: 7 years

A desktop computer can always be repaired. Although external peripherals and laptops have proprietary parts that can make repairs impossible, desktop PCs are basically high-tech LEGO sets, made of industry-standard components. Whether you've crashed your hard drive or fried your processor, a repair often involves little more than snapping in a new part. But is it worth it? Make sure you test drive a new machine before you decide. *—Tim Captain*

WHY DITCH IT ...

If your personal computer is more than three years old, its processor is probably too slow, its hard drive capacity too small, and its other components too outdated to effectively run the latest software. Put the $100 you would have spent on a repair toward a new PC.

WHY FIX IT ...

If your computer meets your needs and you're not planning to buy any power-hungry software anytime soon, a simple fix can make sense. This is especially true if you can turn the repair into an upgrade, such as adding more RAM or installing a DVD burner.

YOU DO THE MATH ...

POWER FAILURE

The system reboots without warning

Part: Power supply, $100
Skill level: Almost anyone
DIY repair: 20 minutes
Pro repair: $200
FYI: Could be a heat problem. Before replacing the power supply, buy a $6 can of compressed air and blast clear the PC's fans and vents.

RAM JAM

New ware makes your PC run more slowly

Part: Random access memory (RAM), $75
Skill level: Beginner
DIY repair: 5 minutes
Pro repair: $125
FYI: Shop carefully: $75 will buy either 256MB or 512MB. It all depends on the manufacturer.

DEAD DRIVE

An error appears onscreen when booting from hard drive

Part: Hard drive, $80 to $400
Skill level: Master geek
DIY repair: Bring your lunch
Pro repair: $180 to $500
FYI: Now you're approaching the tipping point. A shiny new computer is calling your name.

"Although access has gotten trickier, today's appliances are easier to work on once you get in there."

WANDA MARTENS
former major appliance instructor, Dunwoody College of Technology, Minneapolis, Minn.

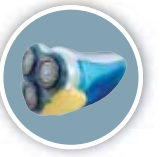
Tinkerer's Friends

All they need is love.

Blender If your $9 coupler shears after a wild night of frozen daiquiris, take two aspirin and call your parts dealer in the morning. You usually can replace this hard rubber piece, which drives the blade, by unscrewing it and screwing on a new one.

Stand Mixer
At $200 to $400 each, you bet they're worth fixing. The most common problem: stripped gears. A pro charges about $60 to $75. If you can open a sealed gearbox and grease the gears when you're done, you'll be mixing again for less than $20.

Vacuum Cleaner
Beater-bar belts are the first thing to go. Pay a technician $25 to install a new one, or do it yourself for the $2 price of the part. Clean out the vacuum head while you have it open. If the motor fails (a rarity), don't bother, unless it's a high-end machine that's very powerful.



Electric Shaver
When the rechargeable battery dies, don't toss the shaver. A technician can replace the battery for about $30. Handy with a soldering iron? Do it yourself for half that.

PHOTOGRAPHS BY RYAN McVAY/GETTY IMAGES (COMPUTER), HEMERA TECHNOLOGIES/ALAMY (BLENDER), INGRAM PUBLISHING/ALAMY (MIXER), HUGH THRELFALL/ALAMY (ELECTRIC SHAVER)

Electric Range

Age: 9 years
Replacement cost: $500
Size: 30 in.
Typical Life Expectancy: 18 years

Your nine-year-old

electric range has a chipped top and a stained door, and everything comes out of it a little half-baked. Still, its harvest gold finish matches the fridge and dishwasher. Will replacing the range lead to a complete kitchen makeover? Maybe that's a good thing!

WHY DITCH IT ...

Hard-pressed for time? New ranges with a convection option bake faster and more evenly while using a bit less energy than conventional ovens. Plus, if you switch from a difficult-to-clean coil-top appliance to an easy-cleaning glass top, you might save enough time to use your new oven to do more than heat frozen pizza.

WHY FIX IT ...

An electric range has few complex parts, and the few it has are easily replaced. Ease of repair is reason enough to leave your range where it is. So is the need to upgrade its receptacle and wiring from three wires to four in many older homes. To have an electrician do this could increase the cost of the swap by $200 or so.

YOU DO THE MATH ...

BALKING BURNER

Intermittent surface burner
Part: Surface element receptacle, $9 to $12
Skill level: Experienced
DIY repair: 30 minutes
Pro repair: $90
FYI: A moderately easy repair, but you'll need wire strippers.

ELEMENT OUT

Surface element won't work, element gets power
Part: Burner element, $25
Skill level: It's a snap
DIY repair: 15 minutes
Pro repair: $110
FYI: You'll find lots of grease on the panel under the element, so have a grease-cutting cleaner handy. Clean up, then close up.

UNCLEAN MACHINE

Oven bakes and broils, does not engage self-clean cycle
Part: Dual-range thermostat, $90 to $150
Skill level: Pros only
DIY repair: See below
Pro repair: $200 and up
FYI: Toxic chemicals in the thermostat's capillary tube, difficult wiring. Who needs a repair like this? Unless you're as good as a pro, ditch.

STICKY DRAWERS

Pot-and-pan drawer won't open properly
Part: Drawer glides, $10 to $20
Skill level: Amateur hour
DIY repair: 15 minutes, tops
Pro repair: $90
FYI: These cheaply made parts need to be replaced all too often.

Window Air Conditioner

Window air conditioners are on their way to becoming disposable appliances. Government-mandated Seasonal Energy Efficiency Ratios (SEER) standards rise every year, pushing energy use down, so a replacement pays its way from the moment you plug it in.

What can you fix? If the compressor runs but the fan doesn't, a fan motor is a $100 part and a 2-hour repair. Other candidates for repair are the selector switch and thermostat, about $40 each. You need better-than-average diagnostic skill for this work. Or, you've just created expensive junk.

Refrigerator

When the sealed refrigerant system goes, exercise the ditch option. Remember, take the door when you cart the bad boy to the curb (this avoids child-entrapment dangers). A good door with a bad cam means you're $10 away from an easy fix. Likewise, a good bulb but a dark compartment signals a bad light switch. Pay the Parts Man $12, pass Go, proceed directly to Fix.

PHOTOGRAPH BY GETTY IMAGES (REFRIGERATOR)

Heart-Breakers

Terminate with extreme prejudice.

Countertop Microwave Oven Even a tiny microwave has a capacitor that stores several thousand volts as part of its power supply circuit. So you're probably better off tossing it or leaving it for the pros. On the other hand, you might as well try replacing the $3 fuse first.

Toaster Oven A broken toaster oven may be the most annoying trash bin candidate. A new heating element for any kind of toaster oven costs about $30, if you can find it. Meanwhile, new appliances range from $20 to $200, with most falling in the $40 to $80 range.

iPod An iPod with a cracked screen or a dead battery—and an expired warranty—makes an ultrachic paperweight. A true übergeek might try to fix one, but that's not a repair—that's a hobby.

Camcorder Ed Van Alstine, an engineer, paid $150—a third of the replacement cost—to get his three-year-old camcorder working. It quit five months later, two months after the three-month repair warranty was up.

PHOTOGRAPHS BY GETTY IMAGES (MICROWAVE AND IPOD), YURIKO NAKAO/REUTERS/CORBIS (CAMCORDER)

Clothes Washer

Age: 7 years
Replacement cost: $750
Size: 2.9-cu.-ft. capacity
Typical life expectancy: 14 years

A good washer can run practically forever. Still, new front-loading models offer cool features and significant energy savings. Better yet, their prices have gone from $1200 to about $600 in the last five years. Is it time for an upgrade? Is that a rattle you hear from the basement?

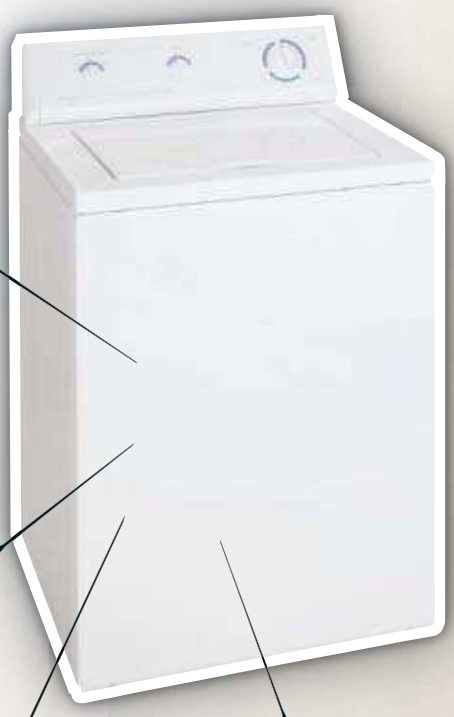
WHY DITCH IT ...

Today's front-loaders use less water (and less heated water) and reduce drying time thanks to spin cycles of 800 to 1600 rpm (compared to 500 to 600 rpm for top-loaders). If you do a lot of laundry, the savings can pay for the machine.

WHY FIX IT ...

Most washer repairs are straightforward. With a few basic fixes you could keep your machine chugging along for years to come.

YOU DO THE MATH ...



NO SPIN ZONE

Washer will not spin or agitate
Part: Drivebelt, $15
Skill level: Semipro
DIY repair: 30 to 60 minutes
Pro repair: $110
FYI: Short on time? Hire a pro. This is one repair that varies considerably depending on access.

RUSTY CLOTHES

Rust spots on washed clothing
Part: Tub, $100 to $200
Skill level: Forget it
DIY repair: Don't make dinner plans
Pro repair: Start at $250
FYI: It doesn't happen often, but a badly chipped tub is the end of the line.

MINOR AGITATION

Agitator moves in only one direction during wash cycle
Part: Agitator, $17
Skill level: Nearly klutzproof
DIY repair: 5 minutes
Pro repair: $100
FYI: Pop cap off agitator, remove bolt. Agitator slides out, new one slides in. There. You're a genius.

THE DRY LOOK

Washer won't fill
Part: Water inlet valve, $35
Skill level: Think you're good? Go for it.
DIY repair: 30 minutes
Pro repair: $120
FYI: Unplug, shut off water, remove hoses. Remove back, remove wires from valve and replace. Bingo.

My rule of thumb

is if your machine has reached one-half of its expected life, don't spend more than half of the replacement cost on the repair."

CHRIS HALL
veteran repair technician, president of www.repairclinic.com

5 Golden Rules Of Appliance Repair

1. **BE SURE IT'S REALLY BROKEN BEFORE YOU FIX IT.** Reset the circuit breaker, and check that the outlet the appliance is plugged into is live.
2. **CUT POWER AT THE SERVICE PANEL.** Then unplug before servicing.
3. **WATER AND REPAIR WORK DON'T MIX.** A wet floor is a slip hazard. Mop it dry before you work.
4. **USE A FLUORESCENT WORKLIGHT.** These are cooler and safer than old-fashioned incandescent bulb lights.
5. **SAFETY GLASSES ARE A MUST.** Dust, dirt, rust and tiny parts can get you right in the eyes, especially when you're crouching in close.

Dishwasher

Age: 7 years
Replacement cost: $550
Size: 24-in. built-in
Typical Life Expectancy: 14 years

You're used to the hum and slosh of Old Faithful, but when something fails, you wonder if a quieter rinse cycle will help you sleep at night. You also look forward to loading dirty dishes directly into the appliance without rinsing them first in the sink.

WHY DITCH IT ...

Newer dishwashers use less heated water and have more efficient pump motors, resulting in modest energy savings (slightly more if you choose an Energy Star appliance). Also a plus: quieter motors and more noise-dampening insulation.

WHY FIX IT ...

Before you base your decision on appliance sticker price alone, look into installation costs. Plumbing and electrical hookups can tack on as much as $150, and that's if you can reuse the old water supply line. If not, you'll pay more.

YOU DO THE MATH ...

RACK RUINED

Dish rack won't roll or close properly
Part: Dish rack rollers, $20
Skill level: No experience necessary
DIY repair: 10 minutes
Pro repair: $100
FYI: No tools needed. Rollers snap in. But if the rack itself is looking dog-eared, consider ordering a new one from the manufacturer.

WET FEET

Dishwasher leaks from door
Part: Door gasket, $30
Skill level: Some experience
DIY repair: 30 minutes
Pro repair: $115
FYI: First, check the seal. Put a powerful flashlight inside washer; close door. Escaping light means gasket is shot or nearly so. Good to check even if water isn't leaking.

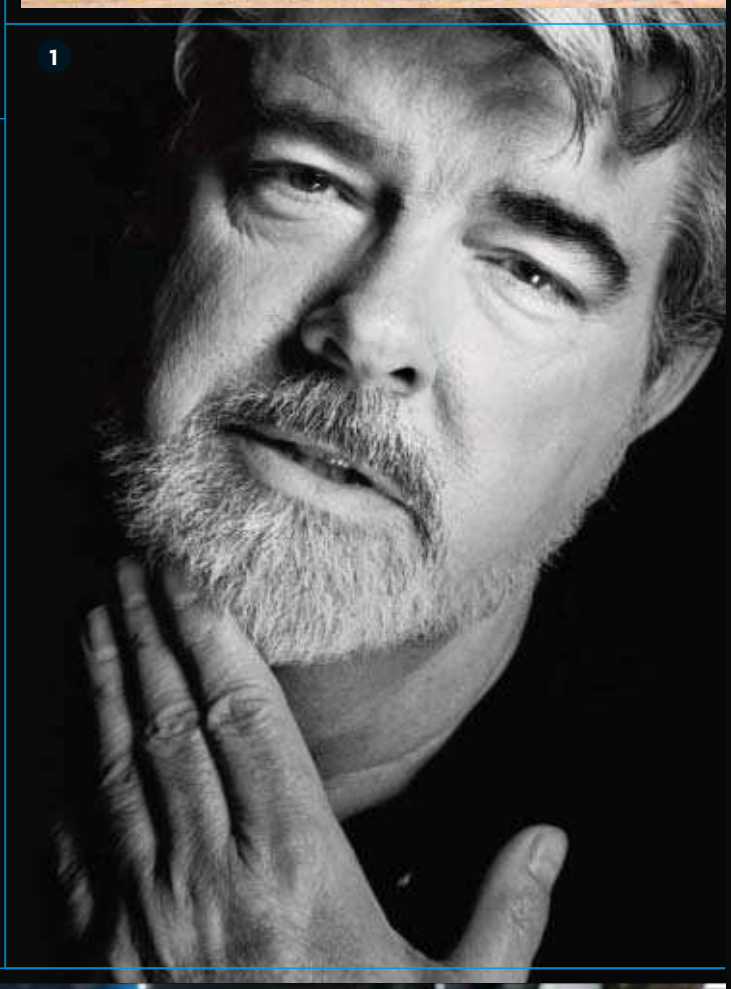
NO POWER

Dishwasher won't turn on
Part: Door latch switch assembly, $40
Skill level: Pretty darn experienced
DIY repair: 45 minutes, maybe
Pro repair: $140
FYI: You can do this repair. Do you want to? If the machine is loud, already leaks a little and its wash ability is spotty, don't bother.

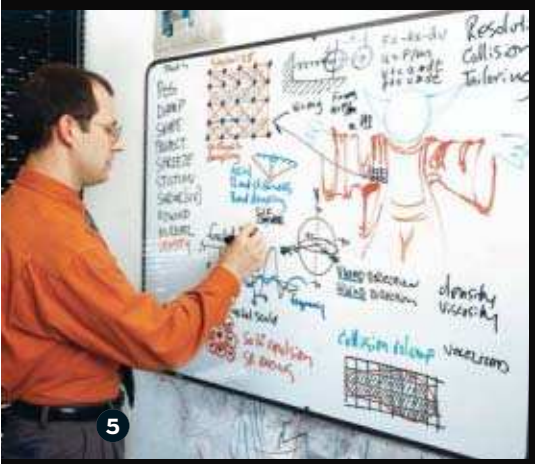
LAZY DOOR

Door drops open when unlatched
Part: Door springs, $30
Skill level: More experience
DIY repair: 30 minutes
Pro repair: $115
FYI: Fix now, not later. Dropping action damages door hinges, and hinge trouble pushes an older appliance into the ditch category.

PHOTOGRAPH BY ANTHONY MARSLAND/GETTY IMAGES (DISHWASHER)



ART OF "WARS": Lucas **(1)** has pioneered new techniques in all six "Star Wars" episodes. Skywalker Ranch **(2)**, in Marin County, Calif., is the heart of the Lucas empire. Shooting the original "Star Wars" on location in Tunisia with actor Mark Hamill **(3)**. Early "Wars" episodes featured models and puppets like R2-D2 and C-3PO **(4)**. Today, animators, including James Tooley **(5)**, rely on computer algorithms to bring characters to life. Lucas insisted on using digital cameras **(6)** to shoot "Episode II" and "III" **(7)**.



The Lucas Effect

THE ORIGINAL "STAR WARS" NOT ONLY INSPIRED MOVIE LOVERS, IT LAUNCHED **A REVOLUTION IN FILMMAKING.** WITH EACH INSTALLMENT SINCE, DIRECTOR GEORGE LUCAS HAS BROKEN NEW GROUND IN **SPECIAL EFFECTS, SOUND QUALITY AND CAMERA TECHNOLOGY.** ON THE EVE OF THE RELEASE OF "STAR WARS: EPISODE III—REVENGE OF THE SITH," LUCAS'S ULTIMATE VISION IS IN SIGHT: **THE TOTALLY DIGITAL MOVIE, FROM SET TO SCREEN.**

by Ron Magid

GEORGE LUCAS ALWAYS hated making movies the old-fashioned way. He has compared traditional, film-based movie production to wearing handcuffs and waging war. But instead of just complaining, Lucas decided that there had to be a better way—and he has dedicated much of his career to finding it. From the digital cameras that are replacing film cameras on movie sets, to the way movies are edited, to how special effects are created, to the sound we hear in theaters and at home, and even (soon) to the way movies are distributed to theaters, Lucas has led the way in adopting innovative technologies. Perhaps no one since Thomas Edison, who pioneered the essential technologies of celluloid, has had such a profound impact on the art of filmmaking.

"Star Wars: Episode III—Revenge Of The Sith," which opens on May 19, is only the sixth movie Lucas has directed. (Others directed two of his six "Star Wars" movies, though he produced the entire series.) But working as a director is only part of Lucas's career in film. He has been involved in producing and writing movies such as "Raiders Of The Lost Ark" and launching groundbreaking ventures, including his production company Lucasfilm, the special effects pioneer Industrial Light & Magic and THX, an innovator in movie sound. "In order to control the creative vision, to advance the art and to make it easier for me to make movies, I've ended up doing all these other things," Lucas recalled recently. "But it's my fascination with the medium that has driven everything."

Rebuilding hot rods as a teenager in Modesto, Calif., Lucas developed an early love of tinkering—along with a testy attitude toward authority. He arrived in Hollywood as part of the new wave of talent—including his friends Steven Spielberg and Francis Ford Coppola—that reinvigorated the movie business in the 1970s. His first movie, the low-budget sci-fi

experiment "THX 1138" (1971), received encouraging reviews; his second, the nostalgic drama "American Graffiti" (1973), was a massive hit. But both were made using traditional film techniques, and, in both cases, the director resented how the movie studios forced him to make changes to the final cuts of the films. He has spent the rest of his career fighting such limitations—both technical and creative.

REVOLUTIONIZING SPECIAL EFFECTS

THE SUCCESS OF "American Graffiti" gave Lucas clout as a director. But his next film, the original "Star Wars," was anything but an easy sell. At the time, science fiction movies were considered commercially risky, and Lucas's sweeping vision would require special effects on a scale never before seen in Hollywood.

The existing special effects techniques—miniatures, matte paintings and stop-motion animation—had evolved only modestly since 1933's "King Kong." Lucas believed it was time for new ideas. "Before 'Star Wars,' the state of the art was 'Tora! Tora! Tora!' and 'Bedknobs And Broomsticks,'" says Lucas's longtime visual effects supervisor, John Knoll, referring to the 1970 war movie's miniature battleships shot in real water (which betrayed the vessels' small scale) and the 1971 Disney film's unconvincingly animated furniture. To create "Star Wars" Lucas assembled a team of bright young modelmakers, mechanics, artists and some of the film world's first cybergeeks. He dubbed the enterprise Industrial Light & Magic (ILM).

The new organization's unlikely name revealed Lucas's determination to make the process of getting the images in his mind onto the screen endlessly repeatable—that is, to industrialize effects. Perhaps the greatest innovation that ILM brought to "Star Wars" was the greatly expanded use of computers to control the motion of cameras and models during special effects (or "FX") sequences, which gave the miniature starships a greater sense of scale and movement.

ILM soon evolved into a kind of FX think tank, with innovations continuing between movie projects. The company's original team eventually became a who's who of future FX masters including John Dykstra ("Spider-Man"), Richard Edlund ("Ghostbusters") and Dennis Muren ("A.I." and the upcoming "War Of The Worlds"). Though the FX images in the first "Star Wars" (1977) were created using cameras and film—not digitally—ILM went on to pioneer entirely computer-generated (CG) effects. The firm's first "morph," or digital transformation of one image into another, appeared in 1988's "Willow." With the stained-glass knight in 1985's "Young Sherlock Holmes," ILM created the first CG character in the history of cinema. Later CG characters included the liquid-metal killer of "Terminator 2," the digital dinosaurs of "Jurassic Park" and, to notably less acclaim, "Star Wars: Episode I's" Jar Jar Binks.

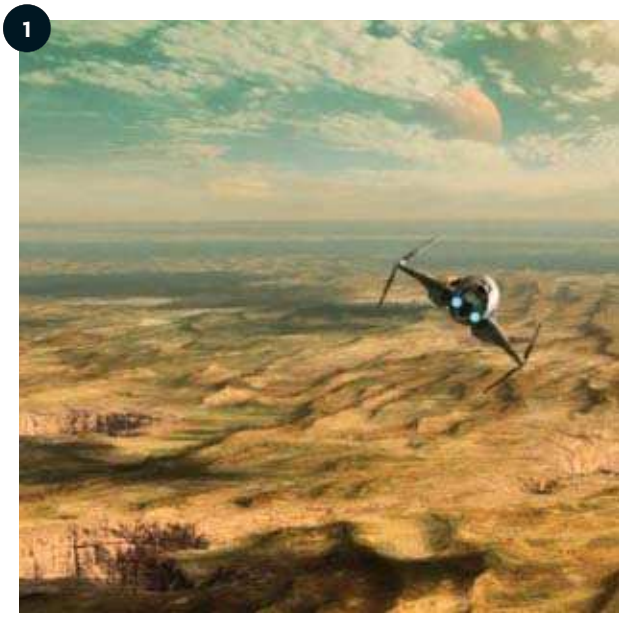
If computers could create individual characters, why not an entire movie? Pixar Animation Studios got its start as

OPENING PAGE PHOTOGRAPHS BY NIGEL PARRY/CPI (1), GREG GORMAN/ICON (2), COURTESY OF LUCASFILM (3, 4, 5, 7)

"EPISODE III" PUSHING FX INTO

BRAVE NEW WORLD: Even in the age of digital magic, intricate scale models remain a key part of Lucas's special effects arsenal. "Episode III" introduces a striking new locale: planet Utapau, whose cities cling to the fissured walls of massive sinkholes. Images of the planet's surface **(1)** are entirely computer generated (CG). But to create the sinkhole cities, Lucas turned to his expert modelmakers. "We built two scale models," says visual effects supervisor John Knoll. "The first was 1/2000 scale and measured about 16 ft. deep. We also built a 1/90-scale section of canyon **(2)** with this big crack in the wall with a whole bunch of Utapau buildings stuffed into it." In one scene **(3)**, General Grevious—a new villain, visible in the foreground—looks over a row of Utapau cliff dwellings. While Grevious is an entirely CG character, the buildings are handmade models (note coffee cup) **(4)**. The film has many scenes in which CG elements and models are combined through the use of "digital paintwork," Knoll says.

1

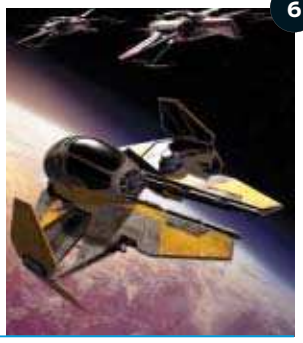


2

ADDITIONAL OPENING PAGE PHOTOGRAPH BY NEAL PETERS (6)

YODA NOW DIGITAL IS: In all three recent "Star Wars" episodes, Yoda has appeared as a computer-generated character. Here, animation director Rob Coleman (right) consults a replica of the Yoda puppet from the original film while refining the digital version **(5)**. With each new installment, "Star Wars" employs a greater proportion of digitally animated images. Even spacecraft, such as Anakin Skywalker's trademark yellow Jedi Fighter **(6)**, exist entirely in the digital domain. "'Episode I' used 60 minutes of animation," Coleman says. "This one has 90 minutes." That's about the length of a typical animated movie, he notes.

5



6

UNCHARTED TERRAIN

3

4

ALL PHOTOGRAPHS COURTESY OF LUCASFILM

a CG research arm of Lucasfilm. (It was spun off in 1986.) For almost a century, film animation had been based on laboriously hand-drawn "cels." Pixar broke that mold with 1995's "Toy Story"—in which every scene was computer generated—and quickly became the dominant force in feature animation, most recently with "The Incredibles."

THE DIGITAL EDITING ROOM

WHEN LUCAS began making movies, film editing involved gluing together strips of celluloid, each of which had to be located from among the hundreds of thousands of feet shot for a production. "I would spend hours looking for a trim [piece of film], knowing it was at the bottom of the bin or a gremlin got it or something," Lucas says. "I wanted to see what I was doing and manipulate it endlessly, then make a creative decision. I was frustrated that I couldn't just deal with the ideas."

By the early 1980s—at a time when computers were barely up to the task—Lucas began pushing his ILM engineers to develop a computerized editing system. Instead of handling strips of film, Lucas wanted to be able to call up shots on the computer screen, assemble them, and then evaluate multiple versions of the scene. The result was a system Lucas called EditDroid. "The [analog] editing process was very antiquated, very cumbersome," he says. "Doing it electronically was so much easier."

Lucas loved the system, but other filmmakers were slow to embrace it. In 1993, he sold the technology to the computer software company Avid. Today, his vision of a nonlinear, computer-based editing system is employed throughout the movie and television industries, and is even found in home editing systems such as FinalCut Express.

BETTER THEATER SOUND

"EPISODE III" sound designer Ben Burtt, who has worked on all six "Star Wars" episodes, recalls his disappointment in seeing the original film in a theater back in 1977. "It sounded great in the studio and then I went to see it with my parents in some theater and it was awful—low and muffled and distorted. It was embarrassing. Most theaters at that time were equipped with speakers designed in the 1950s and people accepted it."

But not for long. "Word got around from the relatively few people who saw 'Star Wars' in 70mm and six-track stereo," Burtt recalls. For the first time, audiences began demanding

better sound. "Out of that came a desire for upgrading systems everywhere and setting standards, which was revolutionary because the audience would hear exactly what we did in the studio."

Lucas still wasn't satisfied. He hired engineer Tomlinson Holman, an audiophile who built his first loudspeakers at age 13, and set him free to tinker. Holman's work launched a sonic revolution, the THX system (the name is an allusion to the first Lucas film), a patented audio recording and mixing technology designed to enhance theater sound.

Lucas leaned hard on theater owners to make them adopt the technology. Today, THX certification guarantees that movie sound meets the company's specifications in more than 2000 theaters worldwide—as well as in home theater systems. For 1999's "Star Wars: Episode I—The Phantom Menace," Lucas upped the audio ante again, working with THX and Dolby on the introduction of the THX Surround EX system, which further enhances aural realism. Burtt no longer worries that his work will be lost on audiences. Even when they play the movies at home, he says, "I can drop in and say, 'That's not too bad!' "

SO LONG, CELLULOID

NOTHING DIVIDES FILMMAKERS like the double-edged sword of digital cinematography. Many cinematographers maintain that digital tape can never match the luster and warmth of 35mm film. Lucas is on a mission to prove them wrong.

"Star Wars: Episode II—Attack Of The Clones" was the first major live-action movie to be shot entirely digitally, using cameras Lucas helped to develop with Sony and Panavision. "This was a giant experiment and nobody knew if it was going to work or if they were pouring money down a rathole," Lucas recalls.

Audiences apparently found that the digitally captured "Star Wars" episode compared favorably with earlier ones shot on film. Not so cinematographers. Wally Pfister, director of photography on "Batman Begins" and "Memento," praises the skill of "Episode II" cinematographer David Tattersall, but believes that the digital recording medium is not yet up to par. "They shouldn't replace film until the technology is equal to or better than film," he says. But Lucas argues that filmmakers need to take the lead in pushing the technology.

What about the last stage of the process? Lucas looks forward to the day when movies are beamed directly to theaters and projected digitally, but concedes, "It's going to take awhile." Skeptics worry such a system would encourage piracy. Lucas believes the studios will embrace it once they see how much money they save by not having to manufacture and ship thousands of prints of each movie. "Eventually, most films will be shown digitally, and a few will be shown on film," Lucas says. "Then, at some point in the future—between 10 and 20 years—there probably won't be any more film."

On the "Episode III" set in Sydney, Australia, Lucas supervises filming of an underwater scene.

THE NEVER-ENDING DIRECTOR'S CUT

ONCE, FILMMAKERS had to live with whatever images they captured through the camera. Digital technology, however, makes it possible to revise everything from the color of the sky to an actor's facial expressions. "We've gone from a photographic medium to a painterly medium," Lucas says. That gives filmmakers "a lot more freedom to determine the look of a movie, and to rethink the movie in the process of making it."

In fact, for Lucas, the creative process doesn't end even when a movie appears in theaters. He has used digital techniques to add new scenes and more complex effects to his reissued "Special Editions" of the "Star Wars" saga. In his 1997 reissue of the original film (now titled "Star Wars: Episode IV—A New Hope"), the director apparently had second thoughts about the way his trigger-happy hero Han Solo (Harrison Ford) shoots the alien slimeball Greedo in the famous cantina scene. In the newer version, Greedo fires first. Next up: Lucas hopes to reconfigure the entire "Star Wars" series in 3D and release it one episode per year as soon as theater technology is ready.

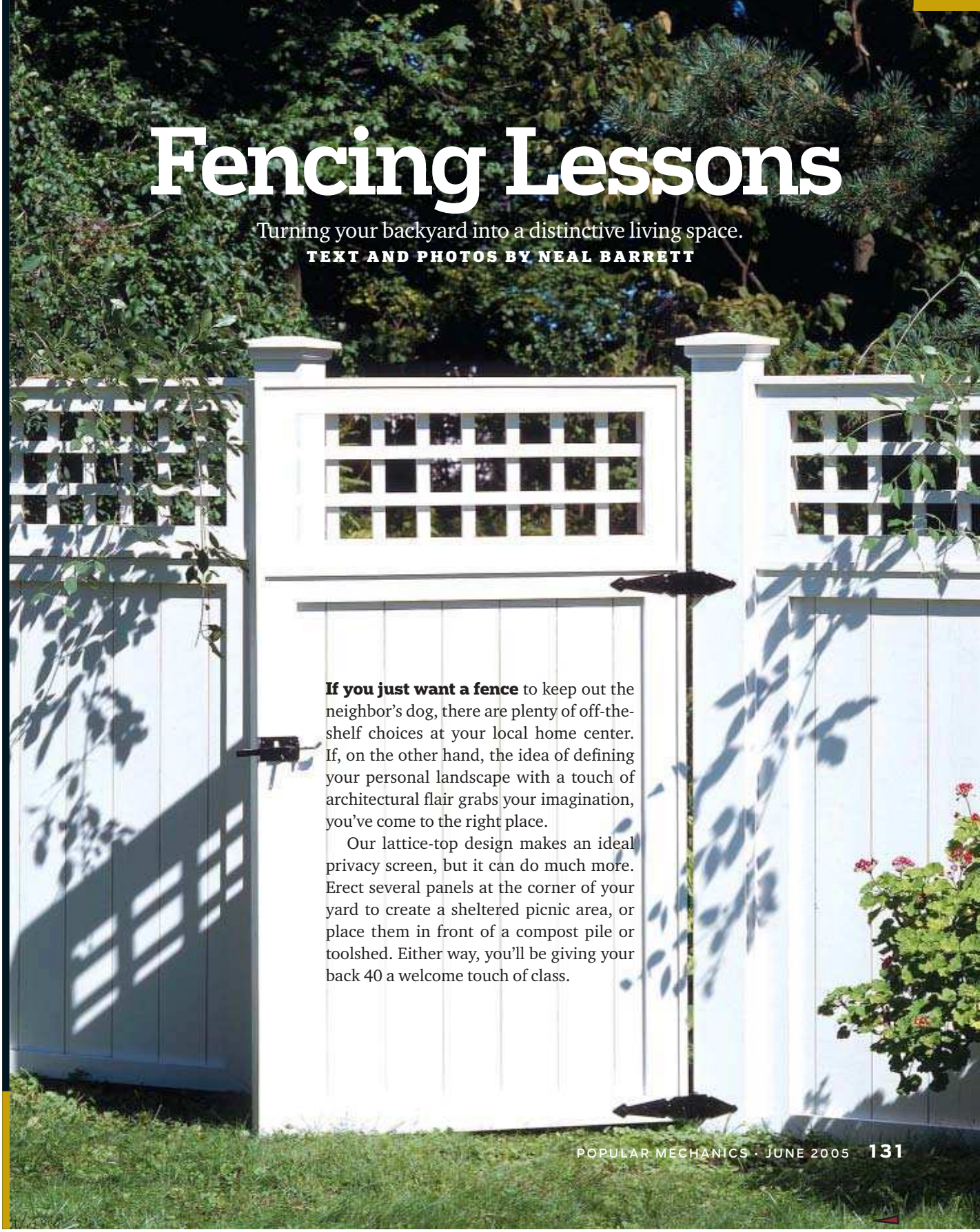
Though purists might decry such endless tinkering, Lucas has managed to change the very concept of what a movie is. No longer a single work of art, frozen in time, a movie in the digital age is becoming more like a lifetime project, something the director rethinks and revises whenever the mood strikes him. **PM**

PHOTOGRAPH COURTESY OF LUCASFILM

Fencing Lessons

Turning your backyard into a distinctive living space.

TEXT AND PHOTOS BY NEAL BARRETT



If you just want a fence to keep out the neighbor's dog, there are plenty of off-the-shelf choices at your local home center. If, on the other hand, the idea of defining your personal landscape with a touch of architectural flair grabs your imagination, you've come to the right place.

Our lattice-top design makes an ideal privacy screen, but it can do much more. Erect several panels at the corner of your yard to create a sheltered picnic area, or place them in front of a compost pile or toolshed. Either way, you'll be giving your back 40 a welcome touch of class.

Material Witness

We built most of the fence with ¾-in. No. 2 common pine. This wood will have knots, and it's a good idea to seal them with a shellac-based sealer, such as B-I-N, so they don't bleed through the paint job. For the cap, lattice and splines, we switched to 5/4 (1⅛ in. thick) lumber and used select grade to avoid the knots. The fence is designed to be built indoors, then assembled on-site. The box posts and sandwiched panels make construction easy—just be sure to study the drawing (page 136) before you begin.

PREP WORK

STEP A

The first step is to rip all the stock to width, beginning with the ⅜-in.-thick lattice strips (1). A portable circular saw will handle the work, but use an edge guide to ensure uniform thickness. Prepare the ³⁄₁₆-in. spline stock in the same way. Then, crosscut all fence pieces to length. To ensure square cuts, guide your saw with a carpenter's square held against the stock edge. Prepare the lattice strips for assembly by marking the cross-strip locations (2). For speed and accuracy, clamp each panel group together and mark all the strips at once.

PANEL DETAILS

STEP B

Join the lattice strips with ⅝-in. brads (3). If the assembly isn't perfectly square, simply pull it into shape before sandwiching it between its two frames. Set the brads below the surface of the wood and fill with glazing putty or exterior wood filler. Plate joinery is the fastest way to create accurate and reasonably strong frame joints. After cutting the slots at the ends of the pieces (C1, D1 and C2, D2), apply waterproof glue, join the parts and clamp for about an hour (4).

Place a frame over a lattice and secure it with 6d nails. Drive the nails about an inch so they don't break through the thin strips (5). Flip the panel over, support it on a few spacers and nail the opposite frame, driving the nails flush. Then, finish driving the nails on the first side.

With all of the lattice assemblies built, nail a divider (F1, F2) to the bottom of each. Use a ³⁄₁₆-in. slot cutter in a router table to cut spline slots in the edges of the bottom-panel slats (I1, I2) (6). You also could do the job with successive passes on a table saw. Prime the splines (J1, J2), use them to join the slats for one panel and lay the subassembly on the floor. Don't glue the splines in the slat grooves, as the joints need to be able to expand and contract. Assemble the lower panels in the same way as the lattice panels (7). Tack one frame to the slats, then flip the assembly over to secure the opposite frame. Then, drive all nails flush.

Stand a lower panel upright and place a lattice section along its top edge (8). Drive nails at an angle through the divider and into the top rails of the lower panel. Secure the endcaps (G1, G2) with 2-in. deck screws (9). Then, nail the top (H1, H2) to the lattice panel rails.

POST BUILDING

STEP C

Box posts make sense because the height of each post can be adjusted to level the fence once it's in place. Keep in mind that you may have to alter post lengths and create a stepped fence if your site is gently sloped. Before you build the boxes, prime the insides of the boards to protect against moisture. Assemble the box parts (K, L) with 6d nails 10. Cut 5/4 stock to size for the post caps and mark guidelines around the edges for the cap bevels. Shape the bevels with a block plane 11. Then, use a chamfer bit and router table to cut the bevel on the cap trim (M).

ASSEMBLY

STEP D

On-site construction will be easier if you join the posts to the panels in the shop, mark and number the parts, and then disassemble them. Use 1¼-in. screws driven through the endcaps (G1) 12. Mark and cut the notches in the gate endcaps (G2) so the hinges and latch hardware will sit flush against the gate rail surfaces. Use a small handsaw to cut the notch edges and switch to a chisel to remove the waste 13. Attach the hinges to the gate and post, and then remove them until final assembly. Slide a pressure-treated 4 x 4 post core 4 ft. into each post box 14. Secure with screws, but make sure that the heads are accessible so post heights can be adjusted on-site. Prime and paint the bottoms of all panels, gates and posts. Once the fence is installed, these parts will be difficult to reach. And, they're the most susceptible to moisture infiltration.

TAKING STOCK

While painted pine was our choice, it doesn't have to be yours. At the low end of the price spectrum is pressure-treated lumber, followed in increasing cost by pine, cedar, redwood, mahogany and teak. These are all woods with some degree of resistance to weathering and decay, although pine depends on a good paint job to survive the elements. Of course, prices vary with availability, grade, size and specific species. For example, western red cedar can cost over twice the price of northern white cedar. And at the high end, teak can run over 10 times the cost of the No. 2 pine we used.

In most cases, you'll find pine, cedar and pressure-treated stock at your local lumber dealer. For the pricier woods, check out mail-order suppliers such as L.L. Johnson Lumber Manufacturing at www.theworkbench.com. —*N.B.*

MATERIALS LIST

KEY	QTY.	SIZE	DESCRIPTION
FENCE PANEL			
A1	4	⅜ x 1⅛ x 77⅝"	select-grade pine (lattice strip)
B1	19	⅜ x 1⅛ x 13⅞"	select-grade pine (lattice strip)
C1	8	¾ x 2½ x 82⅜"	No. 2 pine (rail)
D1	4	¾ x 3½ x 11⅝"	No. 2 pine (upper stile)
E1	4	¾ x 3½ x 46"	No. 2 pine (lower stile)
F1	1	¾ x 3 x 82⅜"	No. 2 pine (divider)
G1	2	¾ x 3¾ x 68⅜"	No. 2 pine (endcap)
H1	1	¾ x 3¾ x 83⅞"	No. 2 pine (top cap)
I1	15	¾ x 5⅜ x 51"	No. 2 pine (slat)
J1	14	3/16 x 1⅛ x 51"	select-grade pine (spline)
GATE			
A2	4	⅜ x 1⅛ x 35⅛"	select-grade pine (lattice strip)
B2	9	⅜ x 1⅛ x 13⅞"	select-grade pine (lattice strip)
C2	8	¾ x 2½ x 39¼"	No. 2 pine (rail)
D2	4	¾ x 3 3/16 x 11⅝"	No. 2 pine (upper stile)
E2	4	¾ x 3 3/16 x 44½"	No. 2 pine (lower stile)
F2	1	¾ x 3 x 39¼"	No. 2 pine (divider)
G2	2	¾ x 3 x 66⅞"	No. 2 pine (endcap)
H2	1	¾ x 3 x 40¾"	No. 2 pine (top cap)
I2	7	¾ x 5½ x 49½"	No. 2 pine (slat)
J2	6	3/16 x 1⅛ x 49½"	select-grade pine (spline)
POST			
K	2	¾ x 5¼ x 73¼"	No. 2 pine (post side)
L	2	¾ x 3¾ x 73¼"	No. 2 pine (post side)
M	4	⅝ x 1⅛ x 6¾"	select-grade pine (cap trim)
N	1	1⅛ x 7½ x 7½"	select-grade pine (post cap)
O	1	3½ x 3½ x 84"	pressure-treated (post core)
FASTENERS			
P	as reqd.	No. 20 joining plate	
Q	as reqd.	⅝" brad	
R	as reqd.	6d galvanized finishing nail	
S	as reqd.	8d galvanized finishing nail	
T	as reqd.	1¼" No. 8 galvanized fh woodscrew	
U	as reqd.	2" No. 8 galvanized fh woodscrew	

Misc.: Waterproof glue; primer; shellac-based sealer; exterior wood filler; paint; 8-in. ornamental strap hinge, Stanley No. 611043; 11-in. heavy-duty thumblatch, Stanley No. 622044.
Note: Quantities indicated are for one gate, one fence panel and one post.

LATTICE-TOP FENCE

FENCE PANEL: 3-3/4" DEEP X 69-1/8" HIGH X 83-7/8" WIDE
GATE: 3" DEEP X 40-3/4" WIDE X 67-5/8" HIGH

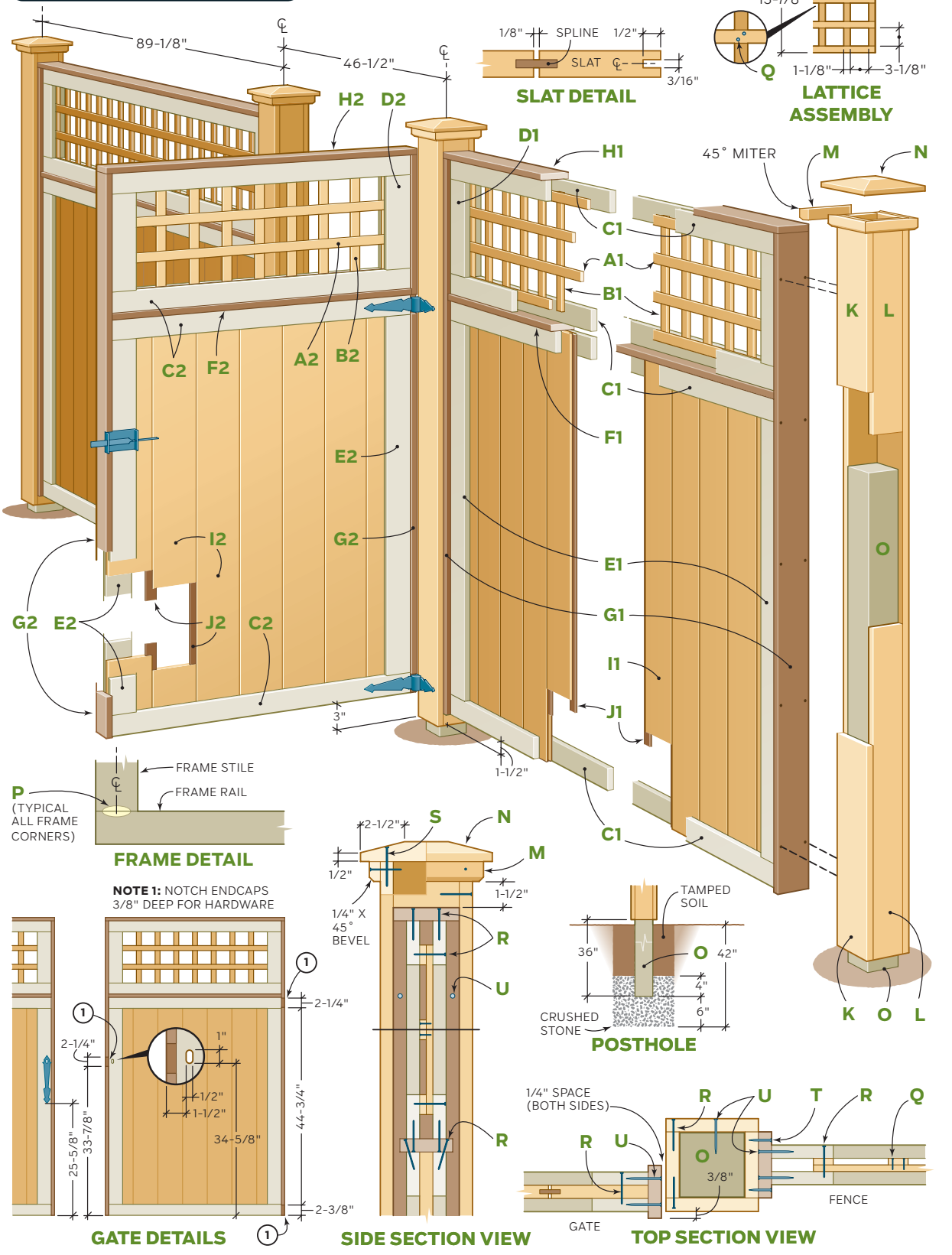


ILLUSTRATION BY **EUGENE THOMPSON**

Stepping Up

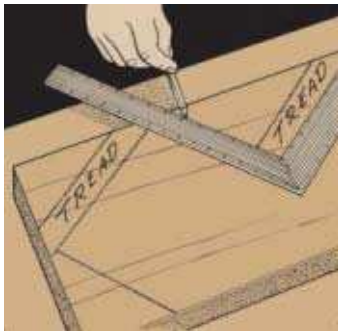
Safe, sturdy and good-looking porch steps are just a weekend away.

BY NEAL BARRETT

If you're intimidated by stair construction, and your back porch steps have seen better days, consider yourself lucky. You have a golden opportunity not only to fix up the homestead, but to conquer the mysteries of riser height, tread width and stringer layout—all in one weekend.

The traditional-style steps that we built feature neat, mitered risers and beaded tongue-and-groove side panels (wainscoting), and are suitable for use either up to an entry or as an access to a porch or raised deck (see drawing below). Except for the beaded side paneling, the structure is made from pressure-treated nominal 2-in. stock for long life out in the weather.

This free-standing design simply sits on a concrete or stone pad. If you don't have a pad, you can either pour one or set flat paving stones into the earth. Since the stair is constructed of pressure-treated material, you could even set it directly on the ground—just make sure that whatever foundation you choose is flat and level.



1 Use a framing square to lay out the stringer. Align riser and tread lengths on the square with the edge of the stock.

2 After laying out the last tread, mark the bottom cut-line. Subtract one tread thickness (1½ in.) from the bottom riser.

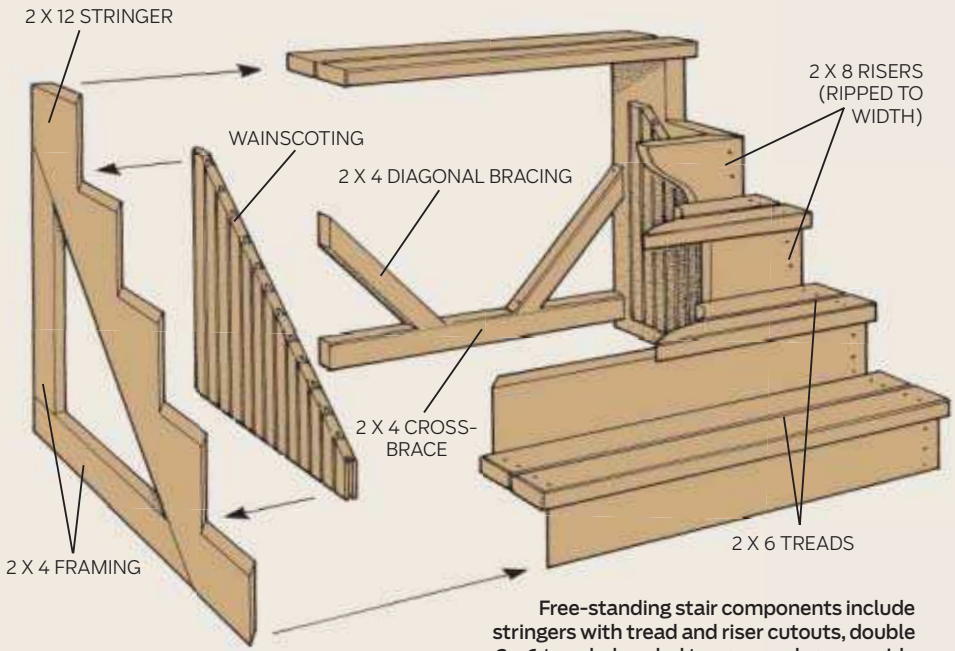
ILLUSTRATIONS BY **GEORGE RETSECK**

Stair Layout

A safe stair demands a uniform riser height (the distance between the treads) of between 6½ and 7¾ in.—or as close to that as you can get. To calculate the height of your risers, measure the distance from your stair footing to your deck or porch surface. Divide that dimension by 7 to get an approximate number of risers. Round the resultant number to the next highest whole number and divide that figure into the deck height. If the resultant height is in the range given above, you've found your riser dimension. If it's too small, divide by the next smallest whole number.

In most cases, this type of stair is built so that the top tread is one step down from the porch surface. To do this, simply subtract one riser height from your overall layout. If you wish, however, your top tread could be made flush with the porch surface.

The width of your stair treads should fall between 10½ and 12 in. We used two 2 x 6s, spaced ¼ in. apart, to yield an 11¼-in.-wide tread



Free-standing stair components include stringers with tread and riser cutouts, double 2 x 6 treads, beaded tongue-and-groove side panels, and 2 x 4 bracing to add rigidity.

(this dimension may vary depending on the actual dimensions of your lumber). When laying out the stringer, make the cuts for the treads 1½ in. less than the actual tread measurement. This way, each tread overhangs the riser below it by 1½ in.

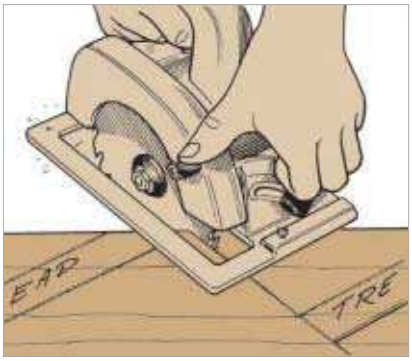
The width of your stair will, of course, vary with its location. For a stair wider than 48 in., plan on one or more center-support stringers.

Use a framing square to lay out the stringers. Place the square near one end of the 2x12 stringer stock, and locate the tread cut (overall tread minus 1½ in.) on the blade (the long arm of the square) and the riser height on the tongue (the short arm of the square).

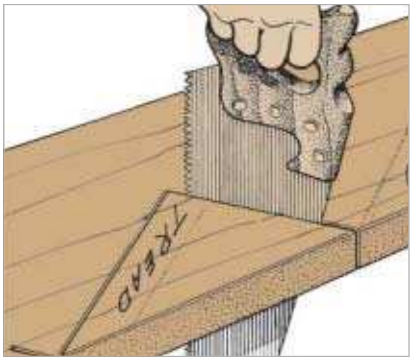
Adjust the angle of the framing square so that these two points are aligned with the edge of the board. Then, trace along the square's blades to lay out the top tread. Next, mark a perpendicular line at the back end of the top-tread layout line to yield the top plumb cut that defines the back edge of the stair.

For the remaining steps, hold the framing square so that the riser height on the tongue of the square intersects the point where the last tread cutline crosses the stringer edge. Adjust the square so that the tread dimension on the blade also crosses the stringer edge 1.

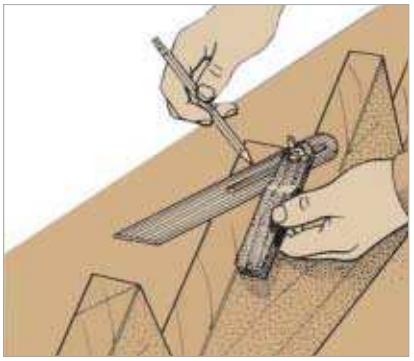
Trace along the square to lay out each step shape. Lay out the bottom-riser cut one tread thickness (1½ in.) less than the other riser cuts, and draw a line parallel to the tread lines from the bottom of this mark to indicate the bottom-level cut of the stringer 2. This cut indicates the edge of the stringer that will sit on the footing.



3 Begin the step cutouts with a circular saw set for a square cut. Follow the layout lines and cut just up to the intersecting lines.



4 Finish cutouts with a handsaw. Hold the saw vertically and cut into the step corner. Use the first stringer as a pattern for the second.



5 After marking inner and outer surfaces on both stringers, use a bevel gauge set to 45° for marking the mitered riser cuts.

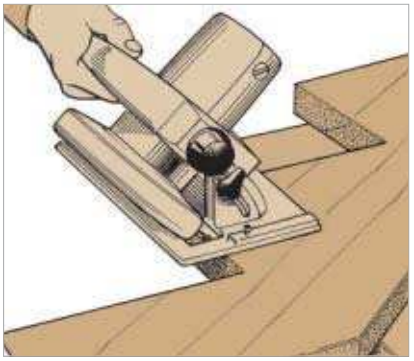
Construction Basics

Use a circular saw to make the top and bottom cuts that define the stringer ends. Clamp each stringer between sawhorses to make the cutouts for the steps. Cut up to each layout line with the circular saw 3. Then use a handsaw, held vertically, to finish each cut 4.

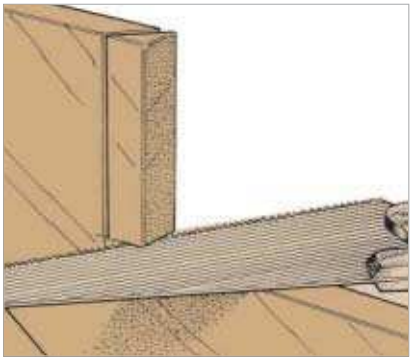
Once the first stringer is cut to shape, use it as a pattern to lay out the opposite stringer. Then cut the second stringer.

Clearly mark the inner and outer surfaces of the stringers. Support each stringer on its bottom edge, and use a bevel gauge set to 45° to mark the miter cuts for the risers 5. Note that the risers are cut back toward the inside surface of each stringer.

Since a circular saw blade can be angled in only one direction, you'll be able to use it to cut miters only on the right stringer, as you face the bottom of the stair. Make the miter cuts just up to the tread line 6, and use a handsaw to complete the cuts.



6 Use a circular saw set to 45° to begin the riser cuts on the right stringer. Use a handsaw to cut the miters on the other stringer.



7 Remove the waste on both stringers with a handsaw. Hold the saw flat against the tread and cut into the mitered corner.

Cut the miters on the left stringer with a handsaw. Support the stringer in a vise, or clamp it to a workbench, to make the cuts. It's easier to make these cuts accurately if you clamp the stringer so that the risers are oriented vertically. With the layout lines clearly marked on the stringer sides, slowly cut down to the tread line. Finish the cut by extending the tread to the bottom of the miter 7.

Side Framing

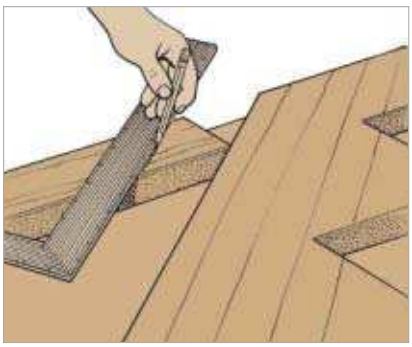
A great technique for completing the layout of the stair side is to use a large worktable or sheet of plywood as a template for the side. It's much easier to visualize the stair, and ensure square assembly, if the stringer is aligned with the square edges of the table or plywood. To use this method, make two marks on adjacent edges of the work surface—one on the bottom edge equal to the sum of the tread cuts and one on the vertical edge equal to the sum of the riser cuts. Align the stringer on these marks and clamp it in place.

Cut the bottom 2 x 4 support at an angle to meet the back edge of the stringer. This angle is the same as the angle of the tread cuts on the stringer. Use the framing square to mark the 2 x 4 ❽, then make the cut with the circular saw. Next, hold the piece in place against the stringer and mark its length at the end of the table or plywood.

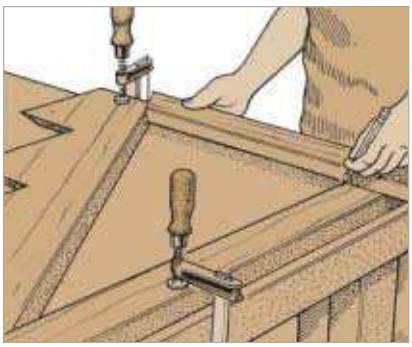
The angle at the top end of the vertical 2 x 4 support is the same angle that yielded the riser cuts on the stringer. Lay out and cut the angle, then hold the piece in place against the stringer and mark its length against the bottom support ❾.

Position the two supports against the stringer and clamp them in place to maintain their position during fastening. Prebore holes for the nails in pressure-treated wood to reduce the chance of splitting. Use hot-dipped galvanized or stainless steel nails to fasten the bottom and vertical support to the stringer and to each other ❿, ⓫.

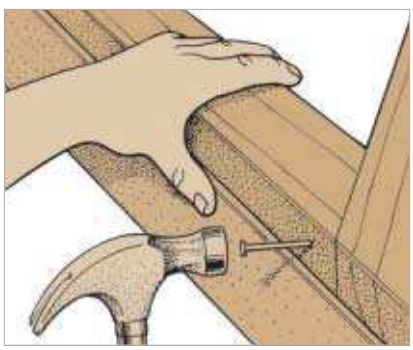
Turn the assembly over, then cut and nail strips of ⅝-in.-thick beaded fir over the opening. This beaded wainscoting material is ideal for this application. Let the strips overlap the stringers and supports by approximately 1½ in., and use 4d nails to fasten the strips to the 2 x 4 framing ⓬.



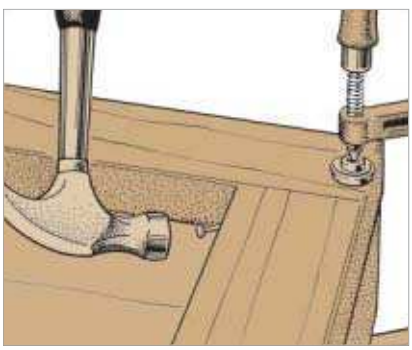
8 Use a square to lay out the angled cuts on the bottom 2 x 4 support. The angle of the cut is the same as the stringer angle.



9 Clamp the side components to a square table or piece of plywood. Mark and cut the vertical support and clamp it into place.



10 Use 10d or 12d nails to secure the 2 x 4s to the stringer. Prebore the pilot holes to avoid splitting the pressure-treated wood.



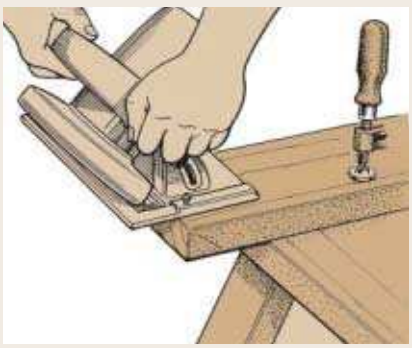
11 After boring the pilot holes, use 8d nails to fasten the bottom and vertical side 2 x 4 supports together. Nail through each side of the joint.

12 Install ⅝-in.-thick beaded fir on the inside surface of the stringer assemblies. Fasten the beaded fir wainscoting in place with 4d nails.

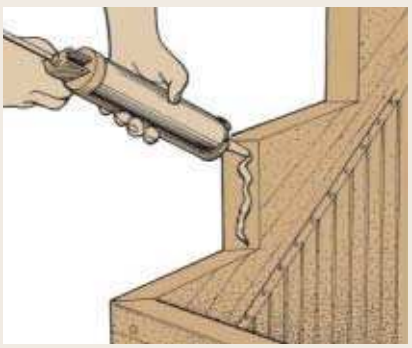
Assembling The Stair

If necessary, use a circular saw and ripping fence to rip the riser stock to width. Our risers were 7 in. wide, which required ripping 2 x 8s to the proper size. Remember that the bottom riser will be 1½ in. less in width than the other risers.

While the ends of the risers must be mitered to meet the stringers, it's easiest to first cut the risers squarely to length. Then, go back and use the circular saw



13 After cutting the risers squarely to exact length, use a circular saw to make the 45˚ miter cuts on each end.



14 Apply adhesive designed for pressure-treated lumber to the riser miter joints before nailing.

to miter each end. Clamp the stock to the sawhorses before mitering 13. By firmly clamping the stock, you free up both hands to control the saw cut.

Next, join the bottom riser to the two stringer assemblies. If you don't have a helper to support the stringers, temporarily clamp them to the side of a table or door while you attach the first riser. After the riser is attached to both stringers, the assembly will be self-supporting. Apply construction adhesive, preferably one designed for pressure-treated lumber, to the miter joints 14. Use 8d nails to fasten the risers to the stringers 15. After nailing, use a chisel to slightly chamfer the corner of each miter joint so it doesn't have such a sharp edge 16.

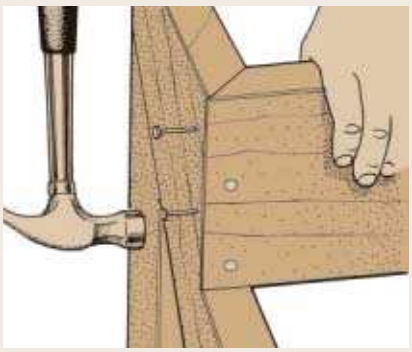
Cut two horizontal 2 x 4 crossbraces for the open back of the stair. Shim the bottom brace 1½ in. off the ground when you fasten it in place 17. This provides clearance for any irregularities along the back edge of the footing that might cause the stair to sit unevenly. Nail the top brace even with the top edge of the stringer assembly 18.

Next, cut two diagonal 2 x 4 braces 18 to 24 in. long with 45° miter cuts at each end. Install these between the bottom crossbrace and the stringer's vertical supports 19.

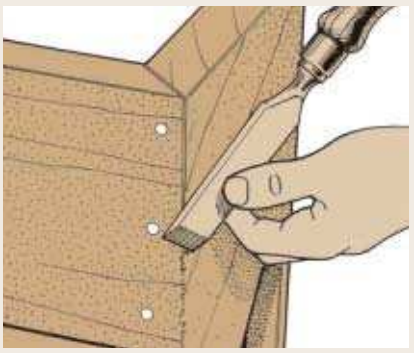
Cut the 2 x 6 stock to length for the treads. Note that the treads should overhang the stringers on each end by about 1½ in. Prebore holes for fastening each tread, then use 2½-in. deck screws to attach the treads to the stringers. Use a ¼-in. shim to create a uniform space between the treads 20. Fasten the inner tread boards to the risers by driving 2½-in. galvanized deck screws through the back side of the risers into the back edge of the tread 21.

Apply two or three coats of alkyd deck enamel, allowing each layer to fully dry before applying the next one. Take the time to cover all inside and bottom surfaces of the stair because all of the stair's parts will be exposed to moisture and, therefore, should be sealed.

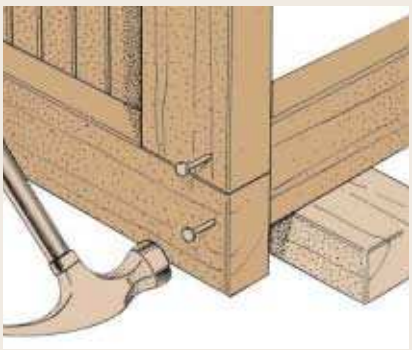
Finally, slide your stair into place against the porch or deck. Use a level to check its position. If necessary, shim the assembly with a cedar shingle. **PM**



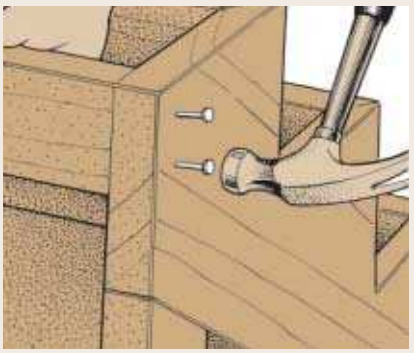
15 Drive nails from both directions when fastening the mitered risers to the stringers. Prebore to keep from splitting the lumber.



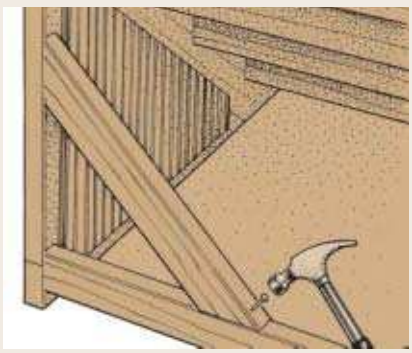
16 Use a chisel to slightly chamfer the sharp corners of each miter joint. Pressure-treated lumber should not be sanded.



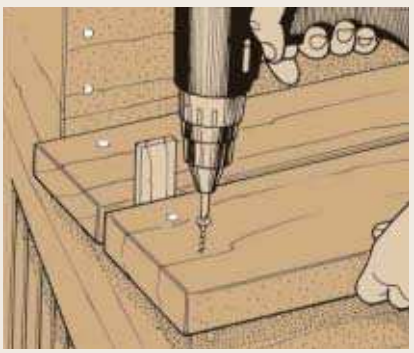
17 Predrill nail holes, then use nails to fasten each side to the bottom back brace. Hold the brace off the ground with 1½-in. stock.



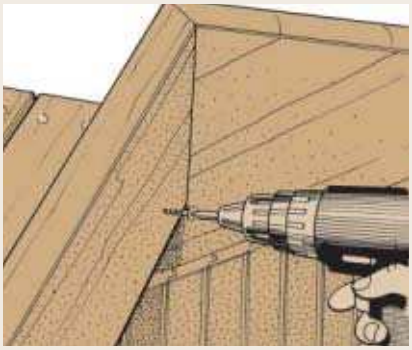
18 Install the top crossbrace flush with the top edge of the stringer. This brace helps support the back edge of the top tread.



19 Install 18- to 24-in.-long diagonal 2 x 4 braces between the bottom crossbrace and the side vertical supports. Toenail the braces in place.



20 Bore pilot holes and install the treads with 2½-in. galvanized deck screws. Use a ¼-in. shim to space the boards.



21 Drive two or three galvanized deck screws through the back of the risers into the back edge of the rear tread boards for extra support.

WHAT YOU'LL NEED

TOOLS:
Hammer, drill, circular saw, handsaw, bevel gauge, framing square, chisel, clamps.

MATERIALS:
Pressure-treated 2 x 12, 2 x 8, 2 x 6, 2 x 4, wainscoting, stainless steel or hot-dipped galvanized 12d, 10d, 8d and 4d nails, deck screws, adhesive.

EXPERT

Q+A

BY NORMAN BECKER, P.E.

Tankless Water Heaters

Q I am considering buying a new water heater and have heard about the instantaneous type. How does it work?

ALEX K.
Via E-Mail

A An automatic instantaneous water heater (that's its full name) is an appliance that heats water as the water is used. It's about the size of a medium-capacity suitcase. Opening a hot-water faucet activates either a burner or electrical resistance heater that transfers thermal energy to a heat exchanger. Cold water is heated as it flows around the heat exchanger.

Something to keep in mind with instantaneous water heaters is that they are designed for a specific flow rate (gallons per minute) through the heat exchanger. Exceeding the flow rate results in a cooler water outlet temperature.

The instantaneous water heater shown here is a Bosch Aqua-Star (www.controlledenergy.com). The company makes these appliances with two capacity levels. One can supply sufficient heated water to a shower and a sink simultaneously, and the other is capable of

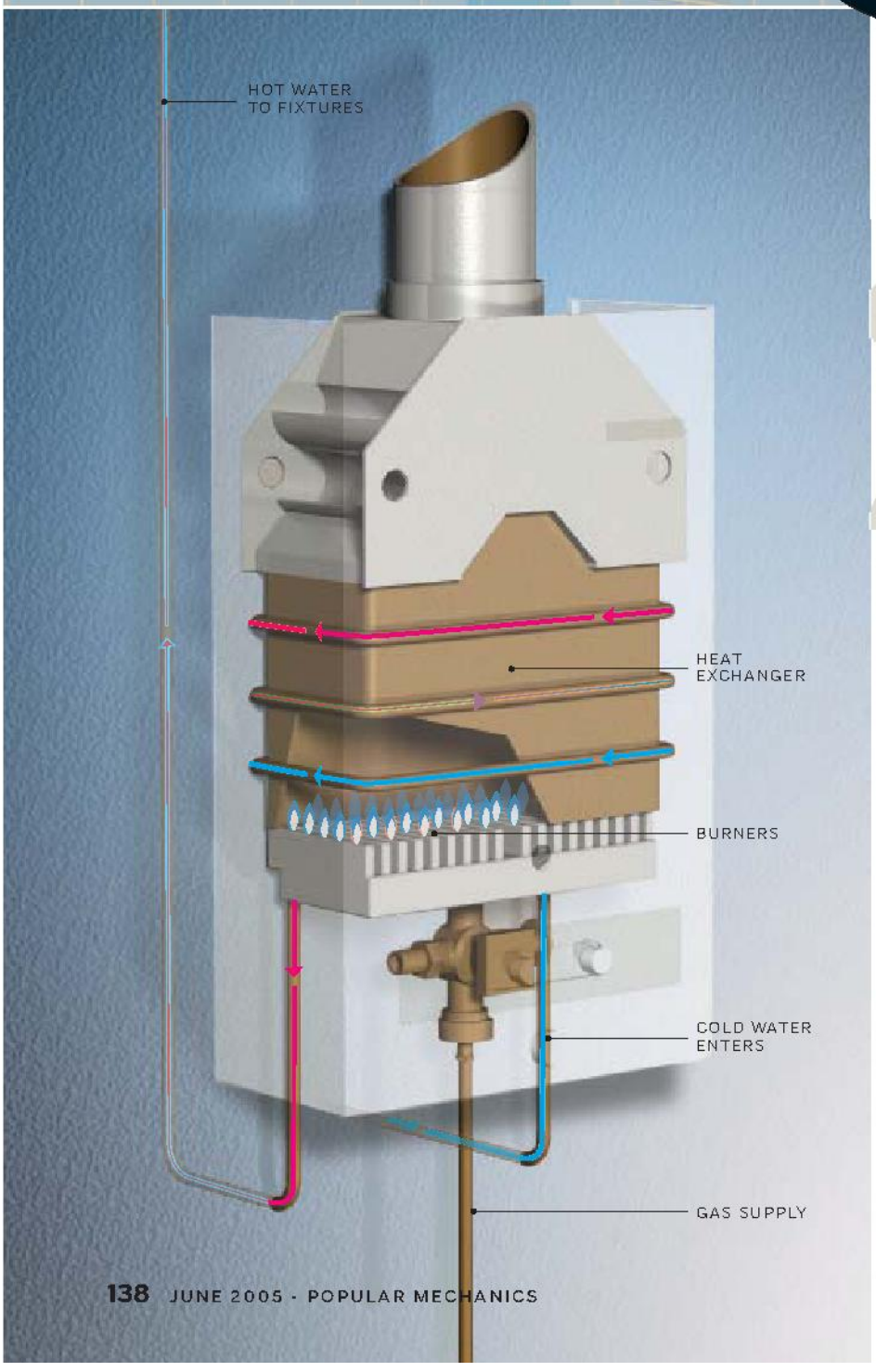


ILLUSTRATION BY **DINO SANCHEZ**

providing hot water for two showers and a sink.

One advantage to instantaneous water heaters is that they can improve comfort by augmenting the supply of hot water in cases where the demand has exceeded the capacity of the existing water heater. Also, these appliances can improve comfort simply because their compact size allows them to be placed close to the point of use. Very little of the water's heat is lost between where the water is heated and where it is used.

Buckled Siding

Q **We've noticed that the new vinyl siding on our house is buckling. Is direct sunlight the cause?**

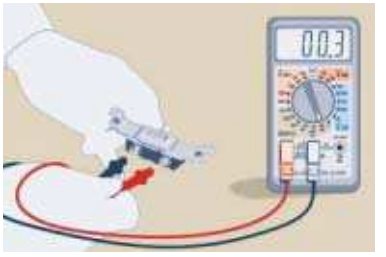
JOAN DONNELLAN
Enfield, CT

A Buckling is usually caused by fastening the siding too tightly to the substrate. This does not allow the siding to contract and expand in response to temperature changes. For example, a piece of siding 12½ ft. long will move at least ½ in. in response to temperature. The siding's oval-shaped nailing slots allow for this, but if the fastener head pinches the siding against the substrate, the

SHORT COURSE

3 Basic Multimeter Tests

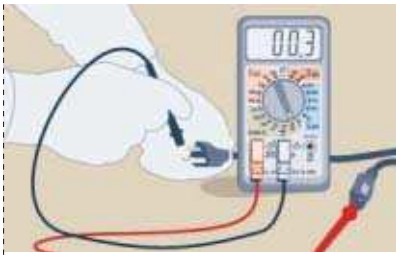
In electrical repairs there's no such thing as "close." A multimeter measures voltage, current and resistance (ohms) and takes the guesswork out of electrical projects. "An inexpensive multimeter does so much, it hardly makes sense to buy an expensive unit," says Carol Fey, author of the diagnostic guide *Quick And Basic Troubleshooting* (www.heatinghelp.com). Here we show a $20 Craftsman 82082. — MERLE HENKENIUS



① Light Switch

PROBLEM A wall or ceiling light won't work after you've replaced the bulb.

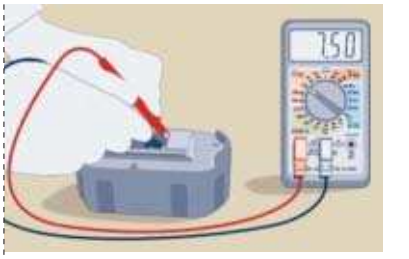
THE TEST Cut power to the switch. Remove it. Use the lowest setting on the multimeter's ohm scale. Press one test lead to each of the switch's side terminal screws. In the switch's Off position there should be no reading, but in the other there should be a complete electrical path indicated by a tiny resistance. Electricity should flow from the meter, through the switch and back to the meter. Replace the switch if it's bad. If it is okay, use needle-nose pliers to slightly bend up the brass tab at the bottom of the bulb socket. Reinstall the bulb and restore power to the circuit.



② Extension Cord

PROBLEM A device plugged into an extension cord isn't working.

THE TEST First, plug a known working device into the outlet and check the outlet's circuit breaker. Assuming the outlet is okay, take the same device and plug it into the cord. If the device doesn't work, the cord is probably shot. Follow this with a multimeter test to be sure. With the multimeter set to its lowest ohm scale, press one test lead into one slot on the cord and the other test lead against the matching prong. A broken wire in the cord will produce a zero ohm reading, while electrical leakage between wires (that should be insulated from each other) will appear as an ohm reading if you test at the opposite prong.



③ Cordless Tool Battery

PROBLEM Your cordless power tool just doesn't have the power that you know it should.

THE TEST A cordless tool's battery is a likely culprit and you can measure its voltage with a multimeter. Run the tool until the battery has a small charge on it, but is not completely discharged. Place it on the charger and when it is recharged, check it with the multimeter set to VDC (voltage, direct current). Use the next-highest setting above the battery's voltage (here, that's 20 volts). Press the test leads against the battery terminals (you don't have to match the test leads to specific terminals). A low voltage indicates that the battery is probably shot. Take the tool, battery and charger to a service center.

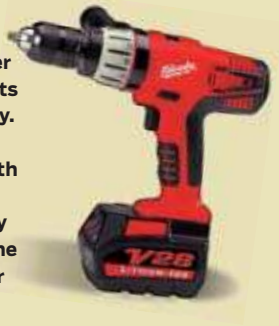
ILLUSTRATIONS BY **JOSEK DESIGN**

TOOL ROUNDUP

A Fine Line

Take your pick. Bosch has introduced three miter saws with arbor-mounted lasers that project a crisp line when you pull the saw trigger. A 10-in. sliding dual-bevel model costs $549, a 12-in. sliding dual-bevel is $649 and a 12-in. dual-bevel (nonsliding), $349. The company plans to introduce a laser kit for its earlier saws. Stay tuned. www.boschtools.com

Power Up



Opening another front in the cordless-tool power wars, Milwaukee has introduced a line of products powered by a 28-volt lithium-manganese battery. Each tool's circuitry is designed to maximize battery performance by improving discharge both under load and while the tool sits unused. The battery weighs less than a typical 18-volt battery but yields twice the run time, says Milwaukee. The drill-driver costs about $450; the 6½-in. circular saw is also about $450. www.V28power.com

Plunge In

Hitachi's KM12SC single-speed router provides as much wood-shaping capability as you're likely to need. The router motor comes with a removable plunge base and a fixed base, both of which are installed or removed with a toolfree clamp mechanism. A plastic case keeps the tool and the ¼- and ½-in. collets, wrenches and seven template guides neatly together. The kit costs $189 at home centers and professional tool dealers. www.hitachipowertools.com

siding will buckle rather than slide back and forth. There should be a 1/32-in. gap between the fastener heads and the siding.

The trade association Web site www.vinylsiding.org has more information.

Vibrating Faucet

Q **Our outside faucet vibrates when turned on. You have to adjust the water flow to eliminate the noise. How can I stop the faucet from making noise?**

KRIS C. KERSCH
Yerington, NV

A Usually the vibration and noise is the result of a loose or defective washer. Once the washer is replaced, the sound goes away.

To begin, shut off water to the faucet by closing the globe or ball valve on the pipe leading to it. This valve is generally in the basement or crawlspace. If the vibration is coming from a bathroom or kitchen sink, turn off the water by closing the valve below the sink or closing the main valve supplying water to the house.

With an exterior faucet, you remove the large nut immediately

below the handle (the packing nut) to gain access to the faucet's interior. The washer is at the end of the faucet's valve stem and is held in place by a small roundhead brass screw in its center. If the screw is corroded, remove it and replace it also.

Backflow Valve

Q **I need information on an anti-backflow valve to prevent basement flooding from a sewer line. Can we install the valve?**

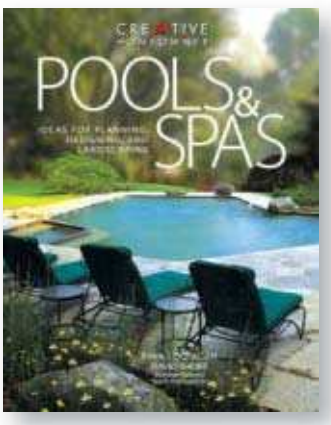
ELIZABETH STEPHENS
Via E-Mail

A Basement plumbing fixtures such as a toilet, bathtub or shower are vulnerable to sewage overflow caused by a backup in a sewer line. This occurs when these fixtures are at a lower elevation than the top of the sewer line in the street.

BOOK REVIEW

CREATING A SUMMER OASIS

Pools & Spas treats its topic as a mechanical one, and that's good. Pool construction, pumps, heaters and skimmers are covered with detail that's hard to find in other books. Especially welcome are the chapters on water chemistry and maintenance. Creative Homeowner, the book's publisher, and the authors deserve credit for providing the clearest explanation we have read on how everything from weather to suntan lotion degrades water clarity. The book spends most of its 10 chapters and 223 pages discussing pools, and slips in some information on spas along the way. Chapter 10 is devoted to saunas, followed by an eight-page Resource Guide and a two-page Glossary. The book costs about $20 at bookstores. Contact www.creativehomeowner.com. — ROY BERENDSOHN



A sewage backup can occur when there is a blockage in the municipal sewer line, or when the amount of sewage and infiltrated storm water exceeds the sewer's design capacity, resulting in a very high flow condition.

Storm water should not be combined with sewage. However, this condition occurs quite frequently. Many homeowners illegally discharge basement sump pumps into a utility sink, which drains directly to the sewer. Open joints in the sewer line also will allow storm water to infiltrate the sewer system.

To prevent sewage flooding problems in a house, a backwater valve should be installed in the main drain line that leads to the sewer. A backwater valve is a check valve

COOL TOOL

PHOTOGRAPH BY BURCU AVSAR

HANGING BY A THREAD

A screw pitch gauge is a multileaf tool with notches cut in each leaf to correspond to specific thread profiles. It sounds like an arcane tool for machinists, but it's useful in a number of home maintenance applications. Without it, the only way to identify thread size is by trial and error. For example, when I replaced a faucet aerator recently, I would have had to buy at least two erent aerators, try them and return the one that didn't fit. Identifying the aerator's threads with a screw pitch gauge saved me that trouble.

We show a Starrett 472, a 51-leaf tool that identifies threads coarse enough to join large pipe and others so fine you need a magnifying glass to make them out (www.starrett.com). Its hook-end leaves allow you to gauge interior threads. It also works on exterior threads. Given that most tap and die sets don't include a screw pitch gauge (or they have a cheapo), my advice is to get a tool like the 472 **(about $47; www.mansontool.com).** — R.B.

that is designed specifically to prevent sewage backflow. In other words, it's a valve that allows flow in one direction, to the sewer, but blocks flow from the sewer into the house.

Hire a licensed plumber to install the valve. But first check with your local building inspector about the plumbing regulations that apply where you live.

Dryer Booster Fan

Q My house has a centrally located laundry room. The dryer's duct has several 90° elbows and makes several long, straight runs before it exits the house. Is there a fan that can be installed in the duct to assist airflow?

HAROLD CRISTE
Florissant, MO

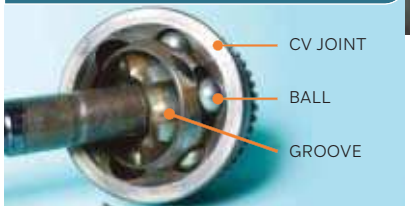
A Fantech has a booster fan that should do the job: Fantech DBF 110. It can be used for a maximum duct length of 60 linear feet with a maximum of six elbows. If your dryer vent is longer than 60 linear feet, call the company's technical department at 800-747-1762 to discuss the specifics of your installation.

The booster fan costs about $225 and must be installed at least 15 ft. from the dryer's back. This allows the lint to dry before it reaches the fan. If you need to install the fan closer than that, you must use the company's lint trap DBLT 4.

The fan and its related components are sold at supply houses that sell electrical, heating, ventilation and air-conditioning equipment. To find a distributor, visit www.fantech.net. **PM**

DO YOU HAVE A HOME-MAINTENANCE OR REPAIR PROBLEM?
Just ask Norman about it. Send your questions to Homeowners Clinic, Popular Mechanics, 810 Seventh Ave., New York, NY 10019 or pmhomeclinic@hearst.com. While letters cannot be answered individually, problems of general interest will be discussed in the column.

DEGREE OF DIFFICULTY
DIFFICULT



RIGHT: A failed boot requires immediate disassembly and cleaning, fresh lube and a new boot.
FAR RIGHT: This joint shows minor wear. Balls and grooves will show wear before the joint fails completely.

SHOP FACILITIES COURTESY BARGAIN AUTO SERVICE, LINDEN, N.J.

SATURDAY MECHANIC

BY MIKE ALLEN

Replacing Front-Drive Axles

That clicking noise that your front-wheel-drive car makes as you accelerate around low-speed righthand corners has been getting a little louder for weeks. One afternoon, just as you pull out of the parking lot, there's a loud banging noise and a series of crunches. Then all forward thrust drops off, punctuated by vibration and the occasional ping of tortured metal. Your CV joint has failed.

THEY DON'T MAKE THEM LIKE THAT ANYMORE

The wheels of your front-drive vehicle are connected to the transaxle via axles that have constant-velocity-type universal joints at each end. There is an inner and outer joint on the left and right axles. All else being equal, the outer joints fail first because they run with the highest angularity—when the wheel is turned, the joint has to redirect the torque from the engine around a corner. The more angle, the more strain. And it's usually the right side that goes first because here in the lefthand-drive US of A, we turn sharper around

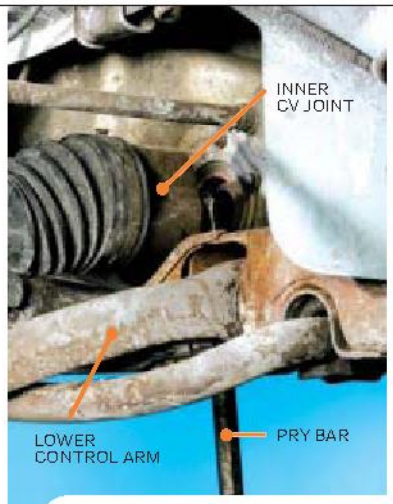
PHOTOGRAPHS BY **MONTE ISOM**

righthand corners than lefthand ones. Sometimes the rubber boots covering the joints fail from age or are torn by road debris, letting the grease out and dirt and water in. As recently as 10 years ago, the repair meant removing the pertinent axle and taking out the failed CV. You'd then replace it and the boot, lubricate the new and old joint with fresh grease, reinstall and go.

Nowadays it's difficult to find a CV joint for sale at a parts store. The industry has made it standard procedure to swap in a complete new or remanufactured axle, with the boots installed and prelubricated. No mess, no fuss—which is good because the moly-sulfide-doped grease specified for CV joints is the blackest, nastiest, most thixotropic (you know, sticky) goop you can imagine, and it will stain your cuticles, your tools and your work clothes worse than printer's ink. You'd never get the stuff out of the washing machine.

You can save some money by buying a remanufactured axle, which will be virtually as good as new. The refurbishing process involves regrinding all the grooves in the inner and outer halves of the joint to a standard oversize, and replacing the cage and ball bearings with new oversize ones.

Start by removing the ball joint's pinch clamp bolt and tie rod end from the suspension upright.



Pry the inner joint free of the transmission. Check a manual for specifics for your vehicle.

GET DOWN

Replacing a front-wheel-drive axle is straightforward, although physically demanding. Get the replacement axle before you start, as well as a new spindle nut and a cotter pin or two. The counterman at the auto parts store will be able to tell you what you need and if the spindle nut needs to be replaced every time it's removed. There may be a new spindle nut in the box with the axle assembly.

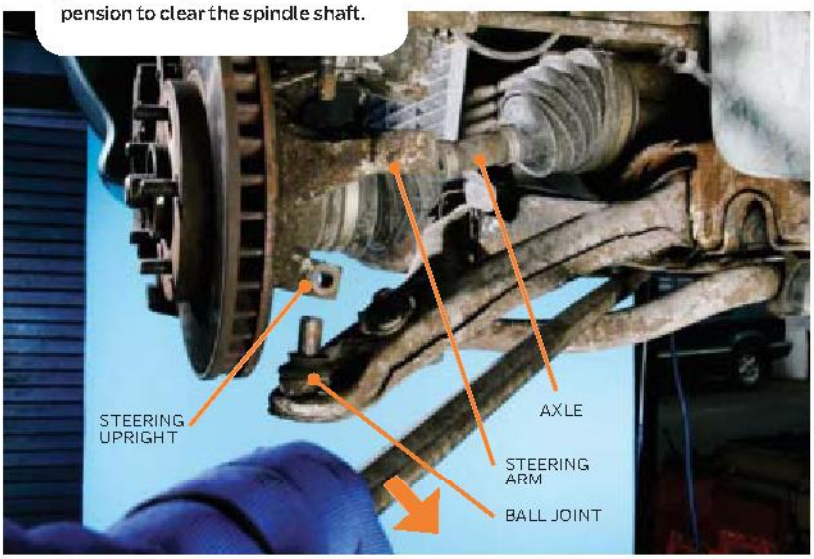
Start by loosening all the lug nuts on the wheel that you'll be working on with the car on the ground. Jack up the car and set the whole front end on proper safety stands, as high as you can. You'll need both wheels off the ground to allow enough suspension droop.

You'll need a big socket to remove the spindle nut. A large crescent wrench or pipe wrench is not an acceptable substitute. Borrow, rent or buy the right socket and a flex handle with at least an 18-in. handle, because that nut may be torqued to as much as 300 lb.-ft. You can use an air wrench to loosen it if you have compressed air available.

At this point procedures may vary slightly, depending on your vehicle's suspension. Consult your shop manual for specifics, but for the most part you'll need to do the following.

Remove the cotter pin from the tie rod end, and pop the tie rod end out of the steering arm. If it's frozen, don't whack the end of the threaded shank with a hammer; you'll probably just ding the threads. Leave the castellated nut a few threads on, and use a big screwdriver or pry bar to lift the steering arm up. Then, smack the rod end a good shot with a hammer and it should pop right

Use a big pry bar to drop the ball joint far enough to allow the suspension to clear the spindle shaft.



out. An alternative is to use two ball-peen hammers and hit both sides of the steering arm simultaneously. There are also threaded pullers for really stubborn cases. If you don't mind destroying the rubber boot on the rod end, you can use a crowbar or a "pickle fork" puller.

Disconnect the ball joint from the suspension upright. You probably can do this by loosening and then removing the pinch bolt at the bottom of the shock. Pull the lower control arm down until the ball joint separates from the steering upright.

This is where it gets tricky. On some vehicles you're in a position to pull the suspension upright and outward enough to let the spindle shaft fall free of its bearing. On many vehicles the suspension arm won't droop far enough. You'll need to disconnect the sway bar and perhaps another suspension piece. Try disconnecting the sway bar, and using a big pry bar and a helper to get the ball joint to clear.

Use pliers to install the tie rod end with a fresh cotter pin. Don't reuse the old pin.

POPPING THE AXLE OUT

Methods of attaching the axle at the transmission end vary. Our example vehicle uses a spring ring that snaps into a groove. We simply used a big pry bar to pop it out. On other vehicles, there's a snap ring that needs to be removed with snap ring pliers to allow the axle to clear the transmission. Check beforehand because using a pry bar until one of these came loose probably would be a bad idea.

Warning: Some vehicles will spill transmission fluid as soon as the inner axle stub clears the seal. Be ready with a drain pan.

Some European vehicles use a ring of bolts to hold the inner CV to the inner stub axle, and the stub axle stays in the transmission case. These bolts probably use a 12-point Allen-type wrench. They are notorious for stripping. Be sure to clean any road grime out of the Allen bolt heads, and seat the Allen wrench into the bolt head with a light hammer tap to prevent this.

POPPING THE AXLE IN

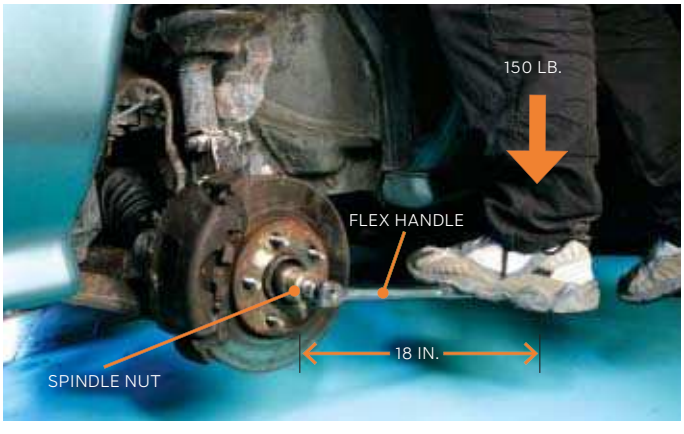
Give the pair of axles, new and old, a critical look to be sure they are identical. For instance, ABS- and non-ABS-equipped cars may use axles that look almost exactly the same, but have differing numbers of splines.

Clean the inner end splines of the new axle to keep from introducing any dirt into your transmission. Slide the new axle home until it's seated, being sure the snap or spring rings are seated in their grooves. Now it's simply a matter of reassembling the ball joint—which will probably require a helper to lean on the pry bar while you stuff the ball joint stud back into its hole in the bottom of the upright.

Reinstall the tie rod end with a fresh cotter pin, button up the sway bar and any other parts you've removed or loosened, and you're ready to torque the spindle nut, reattach the wheel and take the car off the safety stands. PM

HE AIN'T HEAVY, HE'S MY...

That spindle nut needs to be torqued properly, but few shade-tree mechanics have a torque wrench capable of the 200 to 300 lb.-ft. required. Put Archimedes to work. Say the nut is supposed to be tightened to 225 lb.-ft. (Check the shop manual.) If the flex handle you have is 18 in. long, simply put 150 pounds of weight on the end of the handle: 150 pounds x 1.5 ft. = 225 lb.-ft. You may need to find someone who weighs the right amount, or measure out a slightly different place to stand on the wrench. Do the math. And don't bounce up and down—just let your weight do the work.



EXPERT

Q+A

BY MIKE ALLEN

Doing The Twist

I was working on the suspension on my old Mustang and had to remove a brake line to get it out of the way. In doing so, I twisted the end of the hard line up like a pretzel. So I cut it off and used a compression fitting to patch the end of the line. Now it leaks, and the pedal is always spongy.

TERRY O'GRADY
Lansing, MI

Working on old cars is always an exercise in caution and craftiness, no? Those steel brake lines have very poor, if any, anticorrosion coating. They are generally not even galvanized, just painted. After a number of years of being bathed in road dirt and salty spray, they can become nearly impossible to remove. What happened to you is a common failure mode. The hollow steel line corroded and fused to the steel fitting at a place where it's supposed to rotate freely, allowing the fitting to thread into its mating fitting, caliper or master cylinder. When you applied enough torque to unscrew it from the fitting, the line

To remove brake lines, hold the fitting on the rubber line and unscrew the steel line. Use penetrating oil.

ILLUSTRATION BY **MICHAEL LLEWELLYN**

corkscrewed up like a wrought-iron porch baluster.

Your second mistake: Never use a compression fitting on any brake line. Ever. The pressure in the brake line during a panic stop is about two orders of magnitude too high for the design of a compression fitting. You *could* acquire or rent a flaring tool and recreate the factory single or double flare and then splice in a longer piece of line. But don't. Aside from the fact that it's difficult to get a good flare without some practice, think about the line you're trying to save—you already know that it's heavily corroded. And weak.

The only remedy I have for you is to replace the entire steel line. That's not that big a hardship—the line itself can be had for only a few bucks down at the auto parts store. Measure the line carefully, and get one at least as long or a few inches longer. There are a couple of different styles and sizes of fittings, so be sure to match them up. Simply swap in the new line and bleed the system. And on an older car with known corrosion/brake line issues, I'd probably replace every line, not just the busted one. You can simply bend the new lines by hand. Take a critical look at the rubber lines as well, as they don't last forever.

A wider issue: To prevent this from happening in the first place, use penetrating oil on these fittings a day or two before you need to unscrew them. Whack them smartly with a hammer a few times to

NEW PRODUCTS

Glowworm Style

Finding oil leaks is always tough. There's oil everywhere and no way to tell where it's fresh. Try adding a few ccs of Tracerline's fluorescent dye to your oil filler, and then run the engine for a few minutes. Turn off the shop lights and don the kit's tinted glasses, then use the battery-powered Quad Max Pro LED UV light to scout for the glowing dye where it's leaking. There's even a mirror and white LED to visualize the area. ***www.tracerline.com***

READER PROJECT

Billy Shomada

Mechanicsville, VA

Go-kart designer Billy Shomada goes for a drive.

I'm 16 and have been building go-karts and other fun things since I was a little kid. I built my first go-kart at age 12. I always wanted to build something faster, so about a year ago I sat down and drew the design for this one. It will go slightly above 100 mph—though I will never try to drive it that fast. (I ride it on a friend's property.) The go-kart weighs about 380 pounds and is 10 ft. x 5 ft. 6 in. x 3 ft. 9 in. I bent and welded the frame from 1 x 2-in. steel tubing, and cut the exhaust pipes from my Kawasaki 750 to fit. Many of the parts are from street bikes, including the 750cc engine (it's about 65 hp, pretty insane!), the six-speed transmission and the pedal-operated hydraulic brakes. The project took about six months to build and cost around $600. I'm proud to have been asked to head up a team at school for a robotics competition. (I will also do all of the welding.) My dream is to be a mechanical engineer for Ferrari.

For your project to be considered, please send clear, color photos and a brief description to: Reader Project, Popular Mechanics, 810 Seventh Ave., 6th Floor, New York, NY 10019. Any letters and pictures submitted become the property of Popular Mechanics. Unfortunately, we cannot return submissions.

SERVICE TiP

Has your painted aluminum hood started to blister or bubble only a few months after it was repainted? Ford Technical Service Bulletin (TSB) 04-25-1 suggests that iron contamination from body-shop tools and sanding materials may be the cause.

Chrysler TSB 08-026-04 says that delayed updating of the outside air temperature display on 2005 300s and Dodge Magnums is normal. It's necessary to maintain 20 mph for 3 consecutive minutes to allow the display to update.

loosen them. You also can heat them with a torch, then quench them with cold water a few times. The thermal stress will break up the corrosion. Continue to spray them with penetrant as well.

Here's one last tip: Always use a flare-nut wrench to turn these types of fittings to avoid rounding them off. Save the crescent wrench for working on the kids' swing set or the sink.

Family Feud

Q **My father-in-law says he shifts his automatic transmission into Neutral at traffic lights to save wear and tear on the trans and save gas. Right or wrong?**

My son-in-law says he shifts his manual transmission into Neutral at stoplights to save wear and tear on the clutch. Right or wrong?

MICK
Via E-Mail

A I'm afraid to ask what your wife does at stoplights.

I prefer to leave auto transmissions in Drive at traffic lights. The transmission has an internal oil pump that spins constantly, providing lubrication and cooling regardless of what gear the car is in. There are no slipping friction surfaces, only the fluid-coupled torque converter urging the car to creep forward. Shifting to Neutral means cycling the band clutches in and out of gear and causing several valves to open and close. In addition, there are far more moving parts inside the transmission when idling in Neutral than when idling in Drive. Moving

the shifter into Neutral and back into Drive can wear out the linkage. I would recommend shifting into Neutral if you're lighting a cigarette, changing a CD or programming the nav system so that you don't inadvertently creep into traffic. Safety first.

Manual transmissions, on the other hand, are a different kettle of gears. In gear and with the clutch depressed, there are no moving parts at all aft of the clutch disc. But the throwout bearing is loaded and spinning, wearing out. The pilot-shaft bushing, whether it's in the flywheel or elsewhere, is rotating relative to the transmission input shaft. This bushing has little lubricant, and lubing it involves separating the transmission from the engine, which isn't cheap.

But perhaps most important, the pressure of the throwout bearing on the clutch's pressure plate is putting force against the crankshaft's thrust-bearing surface in the crankcase. Eventually, this thrust bearing can wear to the point at which the crankshaft walks in and out. This slight but pronounced fore-and-aft movement of the crankshaft can affect cam and ignition timing and wear the oil seals. Eventually this can precipitate a major bottom-end failure.

A skillful driver can shift a manual transmission into Neutral while slowing down without even using the clutch.

As far as saving gas? Not even a little. **PM**

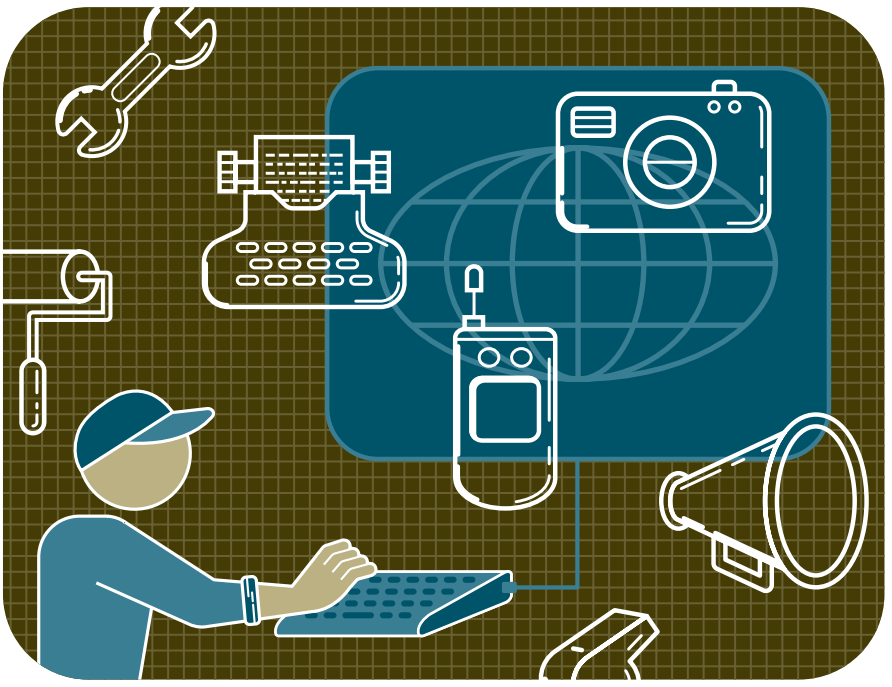
DO YOU HAVE A CAR PROBLEM?

Just ask Mike about it. Send your questions to Auto Clinic, Popular Mechanics, 810 Seventh Ave., New York, NY 10019 or to pmautoclinic@hearst.com. While letters, faxes, phone calls or e-mail cannot be answered individually, problems of general interest will be discussed in the column.

Joining The Blogosphere

Online journals let a guy say what needs saying—on music, politics, cars or all of the above—to a worldwide audience. Getting started is easy.

BY JAMES CURRY



It's an old observation that freedom of the press exists primarily for people who own a printing press. The Internet has changed that, as seen in the growth of blogs, the Web logs (or online journals) that countless people use every day to share their thoughts on everything from Pakistan to pachyderms. Nearly 15,000 new blogs are created daily, according to the blog search engine Technorati, spurred partly by advancing technology. It's getting ever easier to post text, photos and even audio online, and to link to other blogs and news sources. If you want to get started, here's some additional encouragement: Creating a blog is not only fairly simple, it's basically free.

DOING IT THE EASY WAY

The best resources for creating a blog are, appropriately, found online. You could spend weeks sifting through the intricacies of competing software packages and Web hosting services. But if you want to create a blog without getting wrapped up in the details of blog technology, it's far simpler to start with a site that provides one-stop shopping. One of the most popular, feature-packed and easy-to-navigate of these is called Blogger (www.blogger.com), owned by Google. Storage space and bandwidth at Blogger are virtually unlimited. And it's immediately clear that the folks who created the site understand the value of simple interfaces: An online form prompts you for a user name, a password, a display name and an e-mail address. Next, you fill in your blog's title and the address you want. Welcome to the blogosphere.

CHOOSING A LOOK

Making a blog attractive and well-organized can be daunting for anyone lacking experience with HTML, the coded language used for controlling text and images and creating links on the Web. Blogger makes the process idiot-resistant with a gallery of templates. Click on any or all the choices to view them at full size in a new window. Simply pick the one you want, click on Continue, and you're ready to add posts, create a personal profile or customize the look of your creation.

WAXING BRILLIANT

Ready to start spewing your homegrown punditry? An easy-to-decipher screen will walk you through your first post. Choose the title, the font (eight are available), font size (large, medium, small or tiny), text color and other nitty-gritties. You can set the time and date, check a box to allow readers to comment, and preview a post before publishing it. Another option is to save your work as a draft and let it sit for a while before posting it (a wise move for those of us prone to writing drunken rants). If you're not in front of a browser all day, you can send a post using your e-mail pro-

ILLUSTRATION BY **HEADCASE DESIGN**

gram. You can delete posts too. (See "drunken rants" above.)

CUSTOMIZING FEATURES

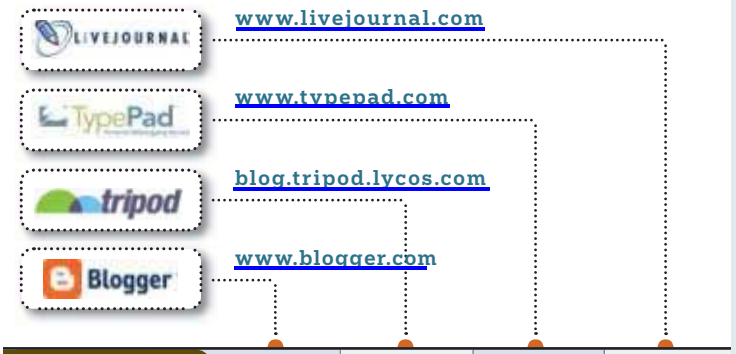
Between fits of penetrating social commentary, take some time to dive into user preferences. Among its other functions, the Settings tab lets you add a 500-word description of your blog and give visitors a way to e-mail posts from your blog to their friends. Other tabs allow you to determine how many posts are shown on the front page, who can comment (anyone or only registered users, for example) and whether you want to receive an e-mail every time someone adds a comment. Advanced users can twiddle with the HTML coding and can redirect the blog to another location, such as a custom URL.

TESTING PLATFORMS

Tweaking the look and feel of a blog may seem empowering, but getting fancy is an act of futility until you view it under a

SITE SELECTION

Setting up a Web log, or blog, can take a few hours or a few days, depending on how technically tricked-out you want it to be—and what kinds of tools you use. All of these Web sites make it (relatively) easy.



	www.livejournal.com	www.typepad.com	blog.tripod.lycos.com	www.blogger.com
Cost	Free	Free*	$4.95, $8.95, $14.95 monthly	Free
Space Provided	Unlimited	20MB	50MB, 100MB, 200MB	Unlimited text
Allows Multiple Blogs?	Unlimited	3	3 ($8.95); no limit ($14.95)	For paid plans only
Ads Posted On Site?	No	Yes	No	No
Allows Video Postings?	No	Yes	Yes	No
Supports Photo Albums	No	Yes	Yes	For paid plans only
Number Of Templates	33	29	15	15
Bandwidth Restrictions	No	Yes	Yes	No
Traffic Statistics Included	No	Yes	Yes	No

* More features offered on fee-based blogs.

variety of operating systems and browsers. For example, text lines may break at different points depending on whether a reader's computer runs the blog on Windows XP or Mac OS X. A help file called the Blogger Browser Matrix includes a chart laying out all the compatibility issues with the major and not-so-major Web browsers: Internet Explorer, Netscape, Firefox, Opera, AOL, Camino and Safari. (At press time, 71 percent of Blogger users were running IE 6 on Windows). If you're not happy with the design of your blog once you see it through others' eyes, simply return to the template tab and click on "Pick new" to choose among a palette of 33 design interfaces.

ADDING VISUALS

Pictures can do more than save you a thousand words apiece; they give your readers' eyes a break, as well. (Color and white space are your friends.) Google's two free photo-management applications, Picasa (www.picasa.com) and Hello (www.hello.com), let you edit and post your pics, and add captions. New photos will appear at the top of your blog. Here's an old Web design tip that has never gone out of style: Use smaller photo file sizes, which load faster on your readers' screens. These days, 100 kilobytes is a fine file size; 3MB may be unwieldy.

PUMPING UP THE VOLUME

One thing blogs did early on was demonstrate how compelling straightforward text can be. Nevertheless, sound files are now adding pizazz to many a site. You can post audio files directly from any phone—for free—by signing up at www.audioblogger.com. (You will be prompted to enter your user name, password, primary phone number and a four-digit PIN.) Call the number (661-716-BLOG) and start talking at the beep. Your message may be up to 5 minutes long, ideal for most songs, quick observations or silly voice-mail messages. Files are saved in the MP3 format. It may take up to 10 minutes for your MP3 file to appear on your blog; when it does, the reader will see a rectangular box that says "Play this audio post." Click on the box and your computer should launch your default MP3 player (like iTunes) and that Interpol song you're dying to share.

SPREADING THE WORD

Unless you're satisfied to have your blog operate in a vacuum, you need to do some promotion. You can add the blog to the listings in the Blogger's Settings section. You also can opt for a site feed—a feature that essentially syndicates your blog and posts it to news aggregation sites like FeedDemon, Bloglines, NetNewsWire and Shrook. A slightly more sophisticated technique involves turning every post into its own Web site by creating permalinks; it allows others to link to the specific post they want—and for search engines to find information on your blog more easily. It requires some HTML coding; refer to the step-by-step Blogger help file. Go to www.google.com/addurl and you can add your blog's Web address, with comments, to Google's index. Also consider adding your blog URL to your e-mail signature, and linking to

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What's going on at Popular Mechanics, and how to reach us.

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WHAT'S HAPPENING

POPULARMECHANICS.COM
This year marks the 10-year anniversary of our Web site, www.popularmechanics.com. To celebrate, we've launched a faster-loading, redesigned home page that features expanded content:

1. **Auto, Tech and Science blogs.**
2. **A Specials channel featuring PM's This Is My Job profiles of professions most of us can only dream of: mountain rescuer, brewmaster, aircr carrier safety o cer, to name a few.**
3. **Great gear from our Upgrade column.**

HARDWARE SHOW COVERAGE
PM's Home editors are going to trek to Las Vegas to the National Hardware Show to bring you the best tools, equipment and building products. This "insiders only" show is open exclusively to the trade. Look for coverage beginning on May 23 at www.popularmechanics.com/hardwareshow

other related blogs. (You'll find a free blog-traffic exchange program at www.pheedo.com.)

UPGRADING THE BLOG

Everything described so far has been gratis. Eventually, however, you may want to add a bell or whistle that's not part of the package deal. This could be a counter, statistics, polls, guestbooks, emoticons or other interface templates—or perhaps you want to upgrade your photo or text editor. If you search hard enough, you can find free versions of all of these added benefits. But programs with serious statistical analyses of your traffic will cost you.

SHAKING THE MONEY TREE

Don't create a blog to make money. There are far more lucrative businesses—anything else, for example—and the blog community is more about sharing ideas and interests. Still, some people get enough traffic to make some profit. How? Google offers yet another add-on service, called AdSense. Basically, it is a way for Google to make something off your site and to pass along a bit of revenue to you every time someone clicks on the ad. You sign up at www.google.com/adsense. If your blog is approved (a process that may take up to 48 hours), you can cut and paste HTML code to your blog that adds targeted ads (not pop-ups) to your site. Google chooses which ads are associated with your site. Chances are a baseball site will get sports-related advertising. Just don't expect to make much money. PM

EXPERT Q+A

BY JOEL JOHNSON

Boosting Ho-Hum Headphones

I'm thinking about buying headphone amplifiers but I'm not sure how they really work. Are they worth the money?

Ordinary headphones tend to produce sound that's, well, ordinary. (No surprise there, huh?) A headphone amp is simply a gadget that makes anything you listen to come through better. "Headphone amplifiers take the signal coming from your iPod, computer, Walkman, whatever, and boost it," explains Matt Myers, a recording engineer at Lagrange Point Studios, based in Kansas City, Kan. "This gives your headphones enough power to accurately reproduce all of the frequencies in the music."

All headphones have an impedance level, which tells you how much the headphones resist the power level of the audio signal. High-impedance headphones produce better sound, but they take more juice. Portable devices normally come with low-impedance hardware, sacrificing acoustics in an effort to extend battery life. But many affordable headphones, short of the lousy ones that come bundled with most portable players, are capable of decent sound. All they need is a small boost from an amp.

The amplifier, which runs off its own power source, sits in line between the player and the headphones, making your music not only louder, but also richer.

Headphone amps aren't just for portables. I use a small AC-powered headphone amp with my home computer to round out the sound from my speakers' headphone line out. If you don't listen to a lot of music with headphones, you probably can give them a pass. For budding audiophiles, though, a low-end $200 amp, such as HeadRoom's BitHead, can make a world of difference, whether you're at your desk or on the move.

Call For Camera Phones

With so many products to choose from, I'm having a hard time picking out a camera phone. Can you tell me the best way to find what I want?

First off, if you want to buy a camera phone, you have to promise to use it for good, not evil. That means no candid shots of, well, pretty much anyone you don't know. Now that we have that out of the way, you could certainly try the standard stuff: reading various reviews online or asking your friends. But lately, I've been using Flickr (www.flickr.com), a free online image hosting and sharing service that lets you search all kinds of uploaded camera phone images. Go to the front page and type in the model number of the camera phone you're considering in the box labeled "Find a photo of …" You can often find a few dozen images taken with each type of camera phone in real-world conditions.

Also, keep in mind that megapixels aren't everything. How the camera phone performs in low-light situations or when capturing moving objects isn't reflected by the megapixel count, but it's just as important. And don't forget to check how well it works as a phone. That's the core application, after all.

Taking It With You

Will satellite radio ever be integrated into a cellphone or MP3 player?

LIMBER LCD

LG HAS BENT OVER backward to make the coolest LCD on the market. Its new 19-in. Flatron L1980U LCD monitor not only folds back, but using AutoPivot technology, it also rotates up to 270° while keeping whatever you're looking at on the screen right side up. If you need to take it with you, the Flatron folds to 66mm slim. But in the end, it's the picture quality that makes the monitor. To adjust the image, check out the LightView presets—six preconfigured modes that let you optimize how you watch movies, play games, surf the Web or even work (if you must). Retails for $899. **www.lge.com**

A What? You can't live without NASCAR radio, the prospect of Howard Stern and the more than 150 stations currently playing on satellite radio services? You're not alone. Satellite radio has become so popular that last year Delphi released the MyFi radio ($350; www.shopdelphi.com), a portable satellite radio player that uses flash memory to record broadcasts (not MP3, exactly, but close enough). I used one for a few days and loved it. And I think there's a real potential for portable satellite radio technology. That said, a few hurdles need to be cleared before built-in satellite radio becomes as common as built-in FM. The biggest one may be the size of the wireless FM modulator, which supplies the product with information from the antenna. The MyFi is a fairly large piece of hardware compared to, say, an iPod. Most of that extra space is needed to wind the wireless FM modulator (about 12 in. long) inside the case. As engineers find more efficient ways to accommodate an antenna, they'll be able to make devices like the MyFi smaller.

Until then, we're in the transistor radio phase of satellite radio, where it takes a whole device's worth of electronics to get what we want. It'll be another few years before we see microchip-size satellite radios that can be tossed into cellphones and MP3 players.

Homebuilt PC

Q My friend just built a tiny PC about the size of a breadbox. He calls this a "small-form-factor" PC but I don't know much about this. Also, I don't think I'm ready to build one myself. What exactly is it and can I buy something like it already assembled?

A Small, quiet and easy to look at, small-form-factor (SFF) PCs made a splash when Shuttle showed off its first one several years ago. They are more widely known among do-it-yourself enthusiasts than general PC users, yet these attractive little machines are a find for anyone who has grown tired of huge, noisy boxes that have to be hidden in cubbies or under desks. Standard DIY kits are usually sparse, including a motherboard, case, power supply and CPU cooler. You need to purchase the other components yourself. What makes the SFF so nice is that it uses standard-commodity PC

parts, so if something goes wrong, there's a good chance you can just go to the store and buy a replacement part instead of sending the whole unit back in for repairs.

Now, if even swapping in a new video card sounds daunting, you might consider buying Shuttle's popular XPC prebuilt; the package includes options for a monitor and all the peripherals you might need (http://sys.us.shuttle.com/home.aspx). Many local computer shops also will be happy to build you a small-form-factor PC. If you simply want small and quiet, however, you might look into the Apple Mac mini ($499; www.apple.com/macmini), a desktop computer that's not much bigger than a stack of CDs. It's cheap and whisper quiet. If you've been thinking about trying out a Mac, this would be a good place to start. PM

PICTURE PERFECT

THE BEAUTY of the new crop of digital cameras is, well, the beauty of them. No longer do you have to tote around some big piece of equipment just to take a photo of your pals at dinner. Slim, light and quite attractive, Fujifilm's new FinePix Z1 digital camera not only packs 5.1 megapixels, but offers a large array of ISO settings made specifically for lower-light settings such as a dimly lit restaurant. Just 18.6mm thick with a nonextending 3x optical zoom, this baby can be carried in your pocket for any occasion. And when you do take it out, you'll love the look and feel of the all-metal body, which comes in both brushed silver and black. Retails for $450. **www.fujifilm.com**

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How to Enter: Beginning at 9:00 a.m. Eastern Time ("ET") on May 2, 2005 until 5:00 p.m. ET on June 13, 2005, you may enter the DIY Do it Yourself Network ("DIY") 2005 DIY Best Built Home GiveawaySM sweepstakes in any of the following ways: (i) online by visiting the DIY website (www.diynetwork.com) (the "DIY Website") and completing the online entry form (limit one (1) online entry, per valid email address, per eligible person per day); or (ii) hand printing your name, complete address and phone number either on a postcard or on a separate piece of paper no larger than 8 1⁄2 x 11 inches, and mailing the postcard or paper to DIY Best Built Home Giveaway, PO Box 52506, Knoxville, TN 37950. Entrants using US mail may enter as often as they wish. Mail-in entries must be postmarked by June 13, 2005 and received by June 20, 2005. Limit one (1) entry per envelope. Mechanically reproduced entries will not be accepted. Incorrect, illegible, and incomplete entries are void. These official rules are also available at the DIY Website or by writing to DIY Best Built Home Giveaway - Rules Request, PO Box 52226, Knoxville, TN 37950. All eligible entries will be entered in the Grand Prize and First Prize Drawings. When you enter at the DIY Website, you may be asked to consent to receive promotional e-mails and reminders for upcoming DIY promotions and information about DIY and the Participating Product Sponsors identified below. Consenting to receive such e-mails is optional and does not have to be agreed to in order to be eligible to enter the Sweepstakes and does not improve your chances of winning. 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Any and all warranties and guarantees are subject to the respective manufacturer's terms. This sweepstakes is governed by U.S. law and is subject to all federal, state and local laws and regulations. Void in Puerto Rico, outside the U.S. and where prohibited by law. How Winners will be Determined: The Grand Prize Winner will be selected in a random drawing from among all eligible entries on approximately June 20, 2005 by an independent judging organization, and will be contacted either in person or by overnight courier and phone on or about June 21, 2005. The First Prize Winner will be selected in a random drawing immediately following the Grand Prize drawing. All non-winning entries from the Grand Prize drawing will be eligible for the First Prize Drawing. Limit one (1) prize per person per household. Judge's decisions with respect to prize winners and other matters pertaining to the sweepstakes shall be final. The winners may be required to sign an affidavit of eligibility and release of liability and publicity (where permitted), and return same, properly executed, within 10 days of issuance of prize notification. If DIY is unable to contact a winner within 5 days of the initial attempt to contact, if a winner or his/her travel companion (if applicable) fails to complete and return all requested forms by the specified date or if a winner fails to comply with any of the requirements, his/her prize will be forfeited and an alternate winner shall be selected. By entering into the sweepstakes, all entrants consent to the use of their name, photograph, likeness, biography, voice and/or video for advertising and promotional purposes, including online announcements, worldwide and without limitation and without additional compensation, except where prohibited by law. The odds of winning depend upon the number of eligible entries received for the applicable drawing. Entry materials that have been tampered with or altered are void. If, in the judge's opinion, there is any suspected or actual evidence of electronic or non-electronic tampering with any portion of the sweepstakes, or if computer virus, bugs, unauthorized intervention, fraud, or technical difficulties or failures compromise or corrupt or affect the administration, integrity, security, fairness, or proper conduct of the sweepstakes, the judges reserve the right at their sole discretion to disqualify any individual who tampers with the entry process and void any entries submitted fraudulently, to modify or suspend the sweepstakes, or to terminate the sweepstakes and conduct a random drawing to award the prizes using all eligible, non-suspect entries received as of the termination date. Should the sweepstakes be terminated prior to the stated expiration date, notice will be posted on the DIY Website. Any attempt by an entrant or any other individual to deliberately damage any website or undermine the legitimate operation of the sweepstakes is a violation of criminal and civil laws and should such an attempt be made, DIY reserves the right to seek damages and other remedies from any such person to the fullest extent permitted by law. In the event of a dispute as to the identity of any winner based on an e-mail address, the winning entry will be declared made by the authorized account holder of the e-mail address submitted at time of entry. "Authorized account holder" is defined as the natural person who is assigned to an e-mail address by an Internet access provider, on-line service provider, or other organization (e.g., business, educational, institution, etc.) that is responsible for assigning e-mail addresses for the domain associated with the submitted e-mail address. Prizes: Grand Prize: One (1) Grand Prize Winner shall win the Grand Prize, which will consist of (i) a home to be built by Main Sponsor in the continental United States with a value of approximately $350,000 (includes the property and the house only) (the "Best Built Home") and (ii) one (1) Ford F-350 Super Cab DRW Lariat 4x4 automobile (approximate retail value ("ARV") of $45,000). Total ARV of Grand Prize is $395,000. Grand Prize Winner will have the opportunity to consult with Main Sponsor as to the location and design of the Best Built Home, subject to the express understanding that all decisions with respect to the location, design, and construction of the home shall be at Main Sponsor's sole discretion and Main Sponsor reserves the right to substitute or change the location of the Best Built Home and to require that it be built in a particular location selected by Main Sponsor. The home shall be conveyed to the Grand Prize Winner without representations or warranties, express or implied, other than those, if any, provided by any contractor/developer ("Developer") from whom DIY has agreed to acquire the home, and other than any applicable manufacturers' warranties. Real estate transfer taxes, deed recording charges and closing costs, if not the obligation of the Developer pursuant to an agreement with DIY (the "Home Contract") to acquire the home, shall be the sole responsibility of the Grand Prize Winner, as will all future real estate taxes and other expenses related to the maintenance of the house. Title insurance and homeowner's hazard and liability insurance shall be the sole responsibility of the Grand Prize Winner. The Sweepstakes Entities shall not be responsible for construction delays. Condition of title to home shall otherwise be as set forth in the Home Contract. First Prize: One (1) First Prize winner will receive $25,000 in cash from Century 21. Total ARV of all prizes in this sweepstakes is $420,000. All costs, taxes, fees, and expenses associated with any element of a prize not specifically addressed above are the sole responsibility of the winner. All federal, state and local taxes on prize are winner's responsibility. Winner will be issued a 1099 tax form for the ARV of the prize. The specifics of all aforementioned elements of any prizes in the sweepstakes shall be solely determined by DIY. Some restrictions may apply. Prizes cannot be transferred, substituted or redeemed for cash except at Main Sponsor's sole discretion. Main Sponsor reserves the right to substitute any prize, or portions thereof, with a prize of comparable or greater value. All prizes will be awarded. Winner's List: Beginning on or about August 1, 2005 you may obtain the name of the prize winners, either by going to the DIY Website (www.diynetwork.com) or mailing a self-addressed stamped envelope to: DIY Best Built Home Winner's List, PO Box 52226, Knoxville, TN 37950. Requests received after September 1, 2005 will not be honored. Main Sponsor: Scripps Networks, Inc. d/b/a DIY Do it Yourself Network, 9721 Sherrill Boulevard, Knoxville, TN 37932.

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Interviewed by Tracy Saelinger / Photograph by Joshua Lutz

Steel Handler

[Tim Brogan, Operating Engineer, NYC Local 14, Years on Job: 10]

Popular Mechanics's future home is a floor in a 46-story tower rising atop New York's historic Hearst Magazine Building. The skyscraper's shell consists of triangles built with 40-ft. columns. In a first for U.S. buildings, there's not a single vertical exterior beam—which poses problems for elite tower-crane operators like Tim Brogan. "It's the most challenging building I've worked on," he says. Brogan often must work in tandem with another crane operator, dangling beams perilously close to ironworkers, yet outside his own view. As the tower nears completion, he's already thinking about a future project, he says. "We're all dying for the new Jets stadium."

BOOM
Made of tubular steel, this bright orange and white boom can extend 200 ft. in any direction with the push of a lever. Brogan can swing it through a full 360° by depressing a pedal.

HOISTS
Brogan's main load hoists (1⅝-in.-thick steel wire rope) can lift up to 57,000 pounds (generators, a/c units) while his ⅞-in. auxiliary hoists take on smaller jobs, like 1-ton steel beams.

MACHINE DECK
Besides the cab, the deck houses a 493-hp diesel engine and 750-gal. fuel tank, plus up to four 23,600-pound counterweights that keep the crane balanced.

CRANE TOWER
Brogan begins his day at 6:30 am with a climb up the 120-ft. crane tower (not shown) to reach the cab. He's got the best views in the house—nice, since he stays up through lunch.