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How to Turn Toxic Waste into Clean Power **p.56**

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**THANK  
GOD IT'S  
MONDAY!  
YOUR JOB  
IN 2017**  
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**The Hummer  
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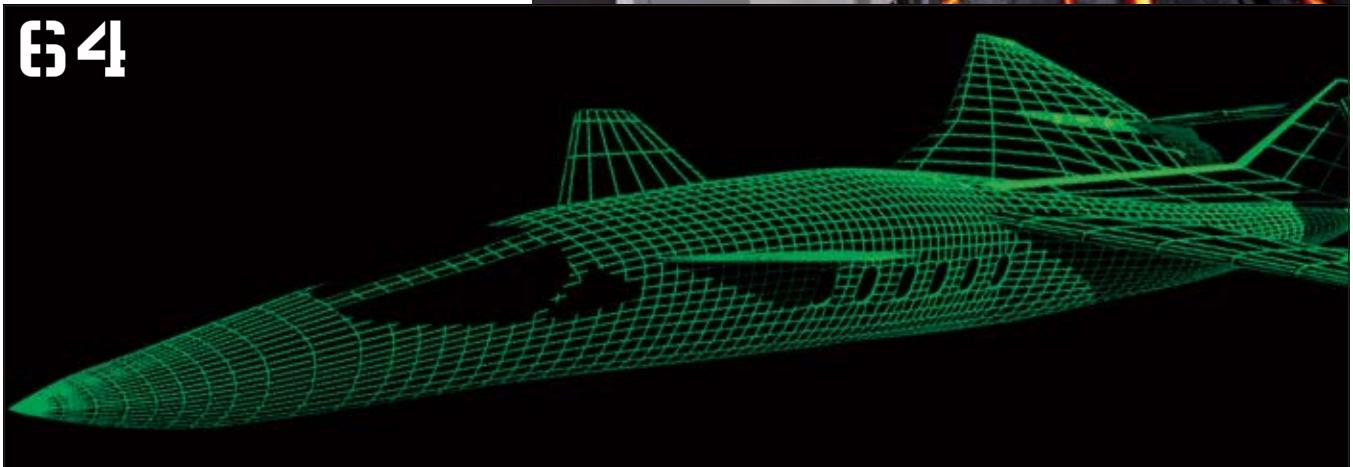
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ON THE COVER: NICK KALOTERAKIS; INSETS, CLOCKWISE FROM TOP LEFT: SATOSHI; COURTESY GM COMMUNICATIONS; THIS PAGE, CLOCKWISE FROM TOP LEFT: GRAHAM MURDOCH; NICK KALOTERAKIS; KEVIN HAND; GRAHAM MURDOCH; KRIS HOLLAND; JOHN B. CARNETT

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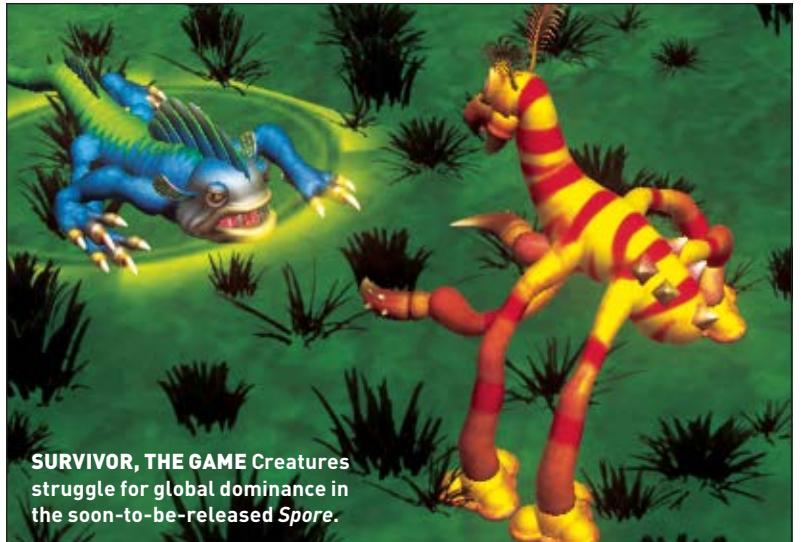
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THE  
FUTURE  
EVERY  
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# PopSci ON THE WEB

WWW.POPSCI.COM



**SURVIVOR, THE GAME** Creatures struggle for global dominance in the soon-to-be-released *Spore*.

## THE EVOLUTION OF GAMING

Take a sneak peek at *Spore*, the new, evolution-based videogame from the makers of *The Sims*, and read the complete transcript of PopSci's interview with game designer Will Wright at [popsci.com/spore](http://popsci.com/spore).

## THE BREAKDOWN

Disintegrating helicopters! Exploding fruit! Tumbling pole dancers! Each Wednesday we pick a Web video of an oddball mishap and invite our experts to explain, in scientific terms, what went wrong. See this week's edition at [popsci.com/breakdown](http://popsci.com/breakdown).

## AND MORE WEB EXCLUSIVES

POPSCI  
PODCASTS

## FROM THE MOON TO YOUR MP3

Tune in every Tuesday as Jonathan Coulton broadcasts special reports (and delivers them in MP3 format) from his satellite office on the moon. This month he'll speak with the inventors of the proposed roller-coaster emergency escape system for the space shuttle, the man who wants to unite tech and trash, and an ice-worshipping family who just couldn't go another season without their own Zamboni.

## LOVE AND GADGETS

If the women in your life are anything like the female staffers at PopSci, they'll take a new laptop over diamond studs any day. See our picks of the best gizmos for girls at [popsci.com/ladiesfirst](http://popsci.com/ladiesfirst).

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# In Praise of Disagreement



**A COUPLE MONTHS AGO**, I set forth as a core POPULAR SCIENCE principle the unswerving support for what I called scientific freedom, and I invited readers to engage me in debate on the subject. The response did not disappoint—more than 60 passionate letters have arrived in my inbox, most of them taking issue with my characterization of “a president in the White House whose actions and policies are often blatantly antagonistic toward scientific freedom.” What disappointed me, though, is that a lack of clarity in my original argument muddled the debate. I didn’t give examples to support my position, and the only specific action of President Bush’s that I cited was his veto of a bill that would have

**“I invited readers to engage me in debate. The response did not disappoint.”**

expanded federal funding for embryonic-stem-cell research. This gave the impression that my beef with the president involves his principled stance on the stem-cell question.

That wasn’t my point. My concern is with the administration’s more widespread—and less principled—tactics. I’m talking about the suppression of government scientists’ research, the editing of reports to downplay findings that don’t jibe with the president’s policies, and the use of

political litmus tests to screen candidates for federal scientific advisory panels.

Notably, scientists themselves are speaking out. A committee of the National Academies has issued a report warning against continued political interference in scientific advisory panels. The editorial pages of *Science* and *Scientific American* have objected to the policies of a White House that “disdains research that inconveniences it.” And more than 10,000 scientists (including 52 Nobel laureates) have signed a statement decrying the administration’s systematic scientific abuse. “When scientific knowledge has been found to be in conflict with its political goals,” the statement reads, “the administration has often manipulated the process through which science enters into its decisions.” The Union of Concerned Scientists has compiled 62 examples of this abuse on its Web site ([ucsusa.org](http://ucsusa.org)), including the USDA suppressing a scientist’s report on the health risks of airborne bacteria from farm waste, and the National Security Council pressuring the EPA to play down its concerns over health hazards near Ground Zero.

One reader wrote that “science with an agenda—conservative, liberal, whatever—serves no general good.” My point exactly.

**MARK JANNOT**

[mark.jannot@time4.com](mailto:mark.jannot@time4.com)

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## Flight of Imagination

As an aircraft designer, I thoroughly enjoyed your article on the Marine Corps's space transport concept ["Semper Fly," January]. One critical issue was only lightly covered, however: the ability to safely land in enemy territory. Similar vehicles, such as the space shuttle, require very smooth, miles-long surfaces for landing. Imagine flying into Southeast Asia and trying to find a suitable landing strip, totally free of obstructions, and then committing to a one-shot landing. And all this is happening while being announced to the enemy by a sonic boom.

**Darold B. Cummings**

Retired technical fellow, *Boeing*  
Coeur d'Alene, Idaho

# "THIRTEEN MARINES DON'T HAVE THE UTILITY TO BE WORTH THE COST OF THE MISSION."

## Semper (Don't) Fly

I'm a U.S. Air Force officer with an aerospace engineering background, so I think I have a pretty good perspective on launching Marines around the world in a hypersonic plane. Please, please do not spend another dime on this project! First, even if the aircraft worked, 13 Marines don't have nearly enough utility to be worth the cost of the mission. Second, any craft that could accomplish this task is far too valuable to risk trying to land in a hostile environment. Third, how could the article gloss over the fact that there's virtually no way to depart the landing zone after the mission is complete? Even if the exotic vehicle could take off again without refueling, it would have to overcome all the same access and diplomatic hurdles that it was originally designed to circumvent.

**Geoffrey F. Weiss**

South Riding, Va.

## Sleep with the Fishes

The idea of an underwater hotel is very impressive ["1,200 Square Feet under the Sea," Jan.], but I recommend that the designers do a little more work on the layout. From what I see in the conceptual pictures, the term "goldfish bowl" comes to mind. Don't look for a lot of takers for the honeymoon suite.

**Tom Brosz**

Via e-mail

## Reinventing the Wheels

"The Power of Two" [What's New, Jan.] states "A new retrofit kit yields the first motorcycle driven by both wheels." This may be the first retrofit kit, but it's not the first two-wheel-drive motorcycle. Rokon in Rochester, New Hampshire, has been making them for 40 years.

**Bill Belanger**

Somerset, N.H.

## The Scientific Resolution

Mark Jannot, I congratulate you for your resolution to open a nonpolitical discourse on things scientific [From the Editor, Jan.]. It is too bad that you then turn political in your last paragraph. The veto you decry disallowed federal funding for new lines of embryonic research, which would have meant more killing of human embryos. If you read two articles in the same issue, "Stem Cells Grow Up" ["The Year in Science: 2007"] and "Medical Magic *without* Embryonic Stem Cells" [Headlines], you would see that the veto is not as important nor anti-science as you seem to imply. A lot of private money is being invested in the research, and in my opinion, that is as it should be. Federal "science welfare" is not very efficient, and as a taxpayer I want as much efficiency as possible. If you're able to keep the political out of the debate, I'm looking forward to reading your input in future issues.

**Edward Binder**

Athol, N.Y.

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# MEGAPIXELS

THE MUST-SEE PHOTOS OF THE MONTH

## ELEPHANT IN THE WOMB

High-tech sonograms and CGI imaging offer a novel trip through life's first stages

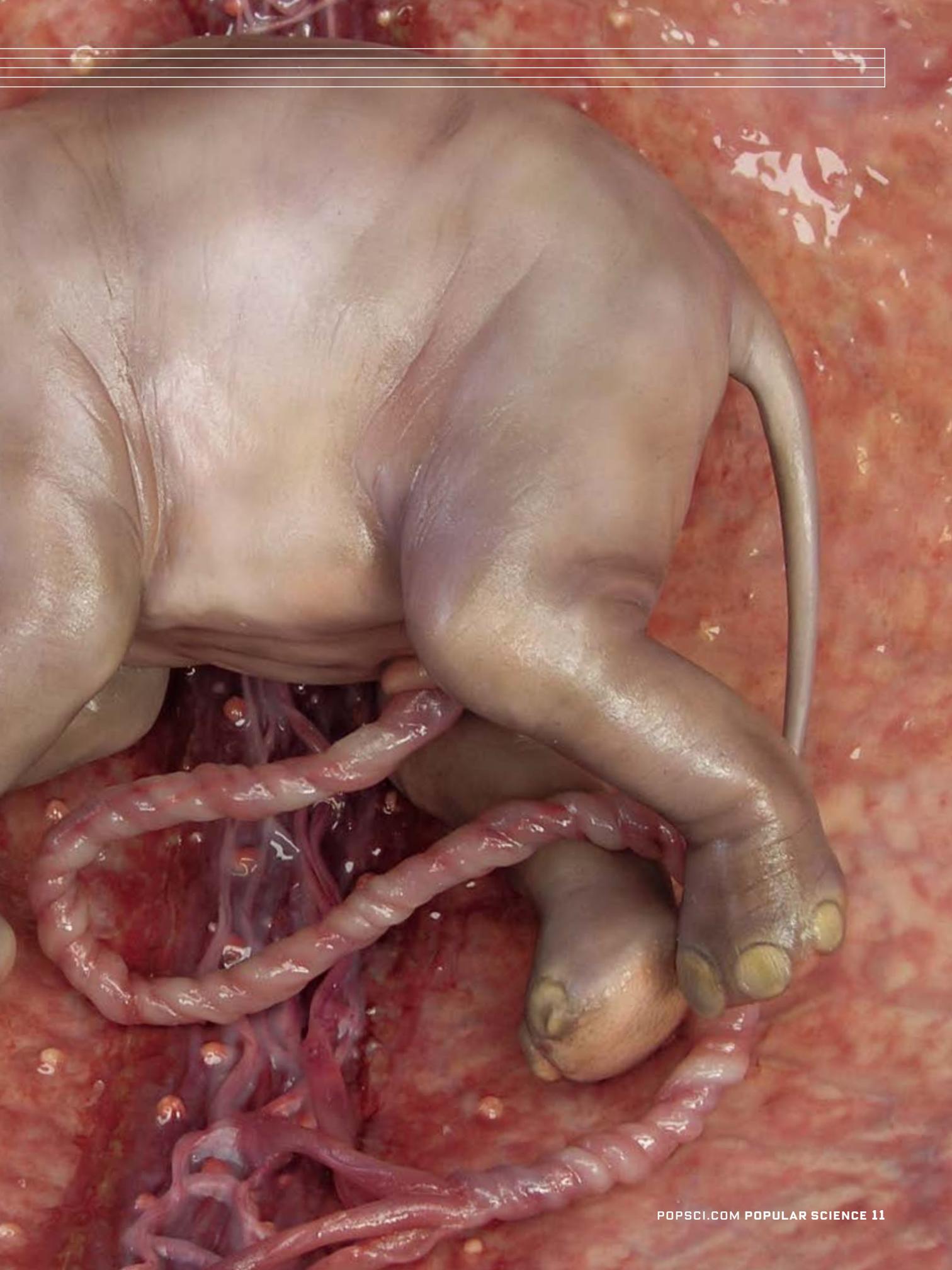
This CGI-enhanced sculpted silicone model of an Asian elephant fetus halfway through its 22-month gestation is the result of almost two years of diligent research, conducted from a rather extraordinary perspective. Veterinarians skilled in the use of 4-D ultrasound (a three-dimensional imaging technique that captures the movements of a fetus in real time) fed a transducer nearly four feet up the rectum of a very patient elephant to monitor fetal development and behavior from inside the womb. The doctors then teamed up with special-effects photographers and CGI experts to bring the entire reproductive cycle to life. The resulting TV special, *In the Womb: Animals*, will air on March 19, at 9 p.m. EST/PST on the National Geographic Channel. Although the researchers also documented the gestation process of a bottlenose dolphin and a golden retriever, the elephant was the only subject to require filming inside the body. The reason? The mother is so huge. So is the baby. At 12 months, the male fetus modeled here is roughly 18 inches long and weighs 26 pounds—about one tenth of the animal's eventual birth weight.

BY TOM COLLIGAN  
PHOTOGRAPH BY DAVID BARLOW



IN THE PINK A model of the elephant fetus at four months





# TOKYO UNDERGROUND

## The world's largest storm drain takes the edge off typhoons

What looks like a postapocalyptic cathedral is in fact a massive reservoir carved deep underground, part of a network of tunnels, tanks and pumps built to ensure that a serious storm won't put Tokyo underwater. The room covers an area larger than two football fields; reinforced concrete columns support the ceiling, nine stories above. This is the last stop for storm runoff in Tokyo's G-Cans System, which includes four miles of tunnels connecting five cylindrical storage tanks that hold 13 million gallons each—all 165 feet underground. From here, four 14,000-horsepower jet turbines (the same type found on 737s) can pump 50,000 gallons of water per second out of the system and into the nearby Edogawa River. The system was completed last summer, 13 years after construction began. Even before it officially came online, it had diverted enough water to dramatically reduce flood damage in the city, where one fifth of residents live below sea level. Let's hope flood-prone American cities are taking notes—and aren't daunted by the G-Cans's \$2-billion price tag. **BY ERIC MIKA PHOTOGRAPH BY JUERGEN SPECHT**



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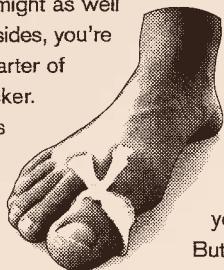


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We'd be willing to venture that you're probably wearing pants right now. And those pants have probably got a couple pockets in front. See there? You've already got a lot in common with this ad. So you might as well just keep reading. Besides, you're now better than a quarter of the way into this sucker. And it's pretty painless so far, right? Good. So let's talk about something that wouldn't be so painless. Trying to stick ten pounds worth of stuff in those pockets of yours. Unless you're already wearing



Haggar® pants with our bigger, unrippable pockets.\* Because if not, all that weight would tear right through and make a b-line for your piggies.

And if you've ever had the pleasure of dropping a sledge hammer on your foot, you know that's something best left to the nincompoops on reality TV shows. Now, would you ever want to stuff 10 pounds into your trouser pockets? Maybe not. But we know how fellas operate. Sometimes you call on your pockets to pull off some pretty heavy duty. So first we make our Haggar "Ten



Pound Pockets" really big.

Then we round the corners so anything from a set of keys to a radiator cap won't get stuck down there. And finally we sew 'em up strong

with our famous Unbustable Seams and embroider on a "Q." What's the Q mean? It means those pants your pockets are part of are guaranteed by Haggar, Gentlemen's Supply Company,™ for as long as you live. So, can these incredible pockets really hold ten pounds? Try 'em and see. Just make double sure your pants have a Haggar Q label first. Or you'd better be wearing a good pair of steel toes.

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# WHAT'S NEW

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**20**  
Headlights that never burn out



**23**  
High-def camcorders for all kinds of shooters



**24**  
The end of cables on your desktop

## RETHINKING THE REMOTE

A new kind of remote control scraps the buttons in favor of motion-sensitive navigation

**THREE HUNDRED** channels and a DVR full of recorded shows, and you're still sifting through it all with a controller straight out of the '80s. That's why Hillcrest Labs designed the Loop, a remote with nary a number on it. Instead, a button brings up an onscreen guide, which you navigate with a scroll wheel. To select what you want to do—browse recordings, change settings—just wave the remote around to move an onscreen cursor through a series of intuitive, icon-driven menus. Accelerometers inside the controller detect where you're pointing (a technology the company calls Freespace). Hillcrest expects to sign deals with set-top-box makers later this year, so you could get one with your next cable box. Now, if only they could make it easier to find in the seat cushions.—MICHAEL MYSER



**▲ CONTROL FREAK**  
The Loop lets you change channels and settings with a wave and a click.



### THE LOOP

**SIZE:** 5 inches across  
**WEIGHT:** 5 ounces  
**BATTERY LIFE:** About three months  
**AVAILABLE:** Late this year  
**MORE INFO:** [hillcrestlabs.com](http://hillcrestlabs.com)

VAPORWARE BET ON IT



COMING SOON?

SATOSHI



**FAST AND SMOOTHIE**

No more banana lumps in your shakes. Inside the world's most powerful consumer blender, a long, wide blade funnels food toward the center, where two sharper blades ensure even pulpage. **Breville iKon Die-Cast Blender \$250; [brevilleusa.com](http://brevilleusa.com)**

**THE GOODS**

12 MUST-HAVE PRODUCTS BY LAUREN AARONSON



**A FAR-SIGHTED ROBOT**

This programmable toy critter shoots infrared beams from its eyes, so it can detect objects up to 13 feet away and navigate through doorways, even in the dark. **WowWee Roboquad \$120; [wowwee.com](http://wowwee.com)**



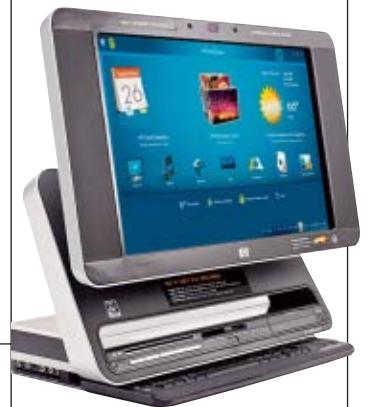
**PUT YOUR FOOT DOWN**

A secret weapon for basketball training: shoes that place your heel below your toes, working your calf to build power for jumps. **SpringBoost B-Train \$140; [springboost.com](http://springboost.com)**



**DOCK 'N' ROLL**

Set your iPod in one room and listen to it in another—or even outside. This dock sends your music wirelessly to up to four speakers, including one that's weatherproof. Eos uses radio waves to carry CD-quality sound 150 feet. **Eos Wireless \$300, base and one speaker; \$130, each additional speaker; [eoswireless.com](http://eoswireless.com)**



**NOW ON TAP**

Replace the bulletin board with this combination PC, TV and digital video recorder. Use the touchscreen to scrawl notes and open programs with one tap. **HP TouchSmart PC \$1,900; [hp.com](http://hp.com)**

**AAA PLACE IN THE SUN**

Juice your rechargeable batteries with free solar power. This charger stores energy in a built-in lithium cell, which can fill four AAAs in two and a half hours. **Sanyo eneloop Solar Charger \$170; [sanyo.com](http://sanyo.com)**



## CONVERSATION HOG

A motorcycle helmet doesn't have much space for gadgets, so this Bluetooth headset does double duty. It answers cell-phone calls and communicates with an included passenger's headset over a radio intercom.

**Cardo Scala-Rider TeamSet**  
\$230; [cardowireless.com](http://cardowireless.com)



## TALKING PICTURES

Give your photos a soundtrack. This speaker-equipped digital frame plays music—or vacation narration—from audio files stored on removable flash drives. Built-in Wi-Fi lets it grab new pics from the Web. **Kodak EasyShare Frame** \$280; [kodak.com](http://kodak.com)



## STEADY STARGAZER

This top-end backyard scope costs a mint and weighs a ton (OK, 500 pounds), but it sits on the steadiest mount you can buy, which means crystal-clear pics of far-off galaxies.

The scope locks easily in place, and the mount electronically balances it. **Meade RCX400 20-inch Telescope on MAX Mount** \$60,000; [meade.com](http://meade.com)



## FUSS-FREE FOCUS

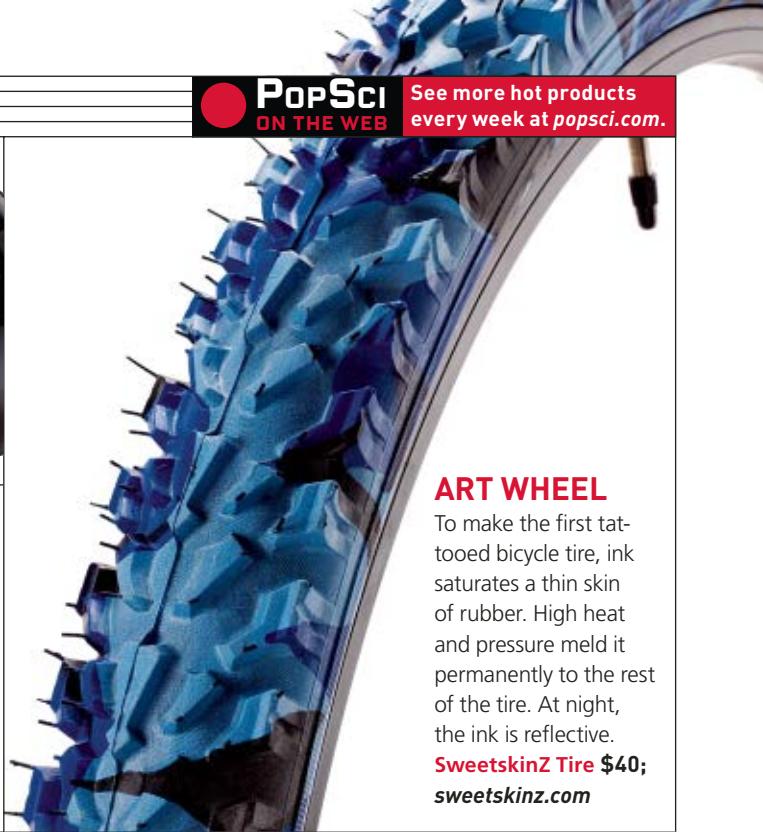
Video chats made clear and simple: This webcam is the first model for PCs that has autofocus and requires no software. **Creative Live! Cam Optia AF** \$130; [creative.com](http://creative.com)



## ART WHEEL

To make the first tattooed bicycle tire, ink saturates a thin skin of rubber. High heat and pressure meld it permanently to the rest of the tire. At night, the ink is reflective.

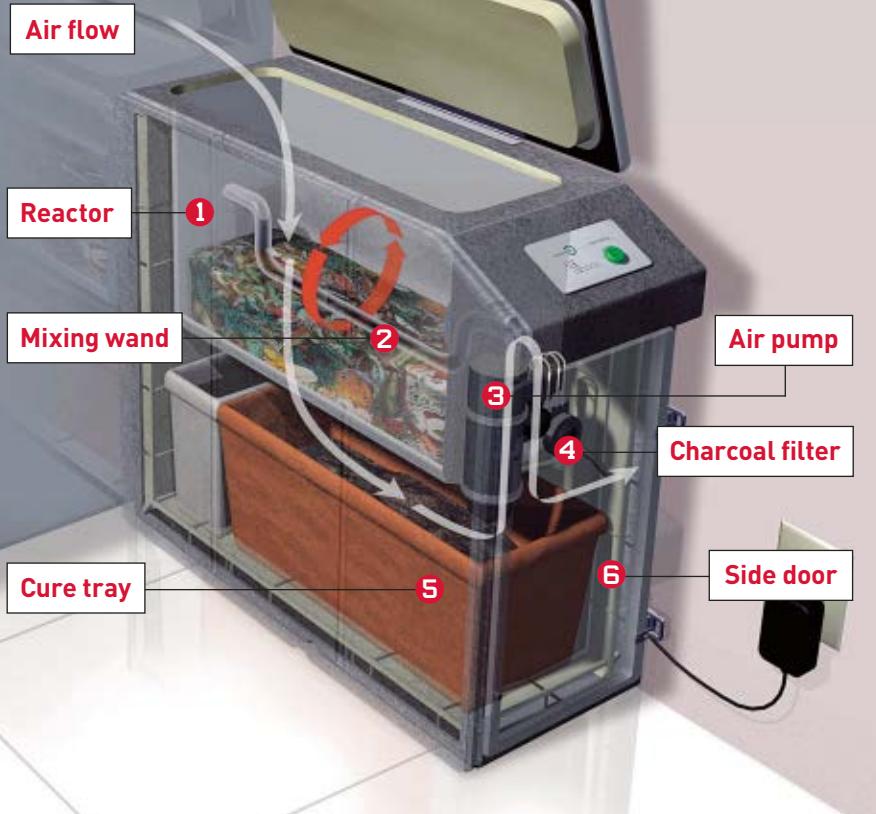
**SweetskinZ Tire** \$40; [sweetskinz.com](http://sweetskinz.com)



## LOCAL NEWS COVERAGE

This GPS navigator pulls real-time updates on local traffic, weather and prices from MSN Direct, Microsoft's wireless information service. Because it uses FM radio waves, it's almost never without a signal. **Garmin nüvi 680 with MSN Direct** \$1,000; [garmin.com](http://garmin.com)





## FOUR MORE GREEN GADGETS



### POWERCOST MONITOR

Keep tabs on your watts—and dollars. This box displays real-time info, radioed by a clip-on electromagnetic sensor near your electric meter. **\$130;** [save-electricity.ca](http://save-electricity.ca)

### SYLVANIA DOT-IT

Its reusable silicon adhesive backing lets you stick this energy-efficient light anywhere. The lamp glows for 100 hours on three AAA batteries, and the three LED bulbs last for about 100,000. **\$10;** [sylvania.com](http://sylvania.com)



### HELIO TUBE

Instead of covering its whole surface with photovoltaic material, this solar panel keeps costs down by using thin strips of it, with reflective troughs to focus light onto them. **Price not set;** [practicalinstruments.com](http://practicalinstruments.com)



### MOIXA USBCELL

Battery chargers never seem to be around when you run out of juice, so you resort to a wasteful one-use battery. Because this rechargeable AA has a built-in USB plug, you can refuel from your laptop on the go. Get up to 500 convenient uses. **\$20;** [usbcell.com](http://usbcell.com)



# WASTE NOT, STINK NOT

The first nose-friendly indoor composter reaches the U.S.

**NATURE IS GOOD** at dealing with organic garbage: Bacteria turns it into plant food. Rural residents use this phenomenon to generate free fertilizer in compost piles. Rotting trash attracts rodents and repels neighbors, however, so those of us off the farm tend to throw out our organic waste along with everything else. But the NatureMill Automatic Composter (\$400; [naturemill.com](http://naturemill.com)) is like a Mr. Fusion for your garden. The size of a normal trash can, it produces enough compost to sustain up to a 400-square-foot plot, while a charcoal filter scotches any odor. Toss in almost any unwanted edibles, and the machine turns them into a nitrogen-rich soil additive. And the NatureMill is easy on the electric bill, costing about 50 cents a month to operate. —CHUCK CAGE

## HOW IT WORKS

As you add organic waste to its **reactor** [1], the NatureMill's computer monitors bacterial activity to see if it needs to turn on its heater or **mixing wand** [2] to encourage growth. The **air pump** [3] draws oxygen into the compost to feed the bacteria. Stale air is desiccated through a **charcoal filter** [4] and vented out the back. In about a week, compost drops into the **cure tray** [5], freeing space for new waste while leaving behind enough compost to maintain the cultures. Open the **side door** [6], and get thee to the garden!

## Why Hollywood Loves HD DVD

Tuner cars land with extra crunchiness  
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*Mic Rodgers, Stunt Coordinator  
The Fast and the Furious*



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\*Resolution comparison based on 480i vs. 1080i pixel counts. © 2007 North American HD DVD Promotional Group, Inc.

COMING  
SOON

# BRIGHT EYES

With LED headlights, you'll never be stopped for a burned-out bulb again

**LED HEADLIGHTS CONSUME** just half the power of today's best xenon bulbs while pumping out more light. And they'll glow for up to 50,000 hours before they even start to dim, never mind burn out. (The average car runs its headlights about 500 hours a year, so imagine how many evening pickup games you could light with LEDs.) Because high-current bulbs suitable for the road are still pricey, they will debut as an option on only two 2008 cars, but they could trickle down to more models within five years.—DAN LIENERT



## 2008 AUDI R8

On a dark road, seeing far ahead is critical in a 190mph supercar, which is why Audi's R8 is the company's first model with LED headlights. Since the lights are so much more compact than incandescents, the R8's designers were able to place them in unusual spots, recessing them far back beneath the hood and fanning them out in a design inspired by the Sydney Opera House.

**\$110,000 to \$115,000; [audiusa.com](http://audiusa.com)**



## 2008 LEXUS LS HYBRID

LEDs powerful enough to function as headlights carry a blue tint, but Lexus wanted the beams on its forthcoming LS Hybrid [detail above] to match the hue of solar radiation because that's what people see best. So engineers enveloped the blue LED source under a yellow fluorescing layer, which is "excited" by the LED's light to produce the desired color balance.

**Price not set; [lexus.com](http://lexus.com)**

## MORE LEDS IN CARS

### 2007 MERCEDES-BENZ E63 AMG

The Mercedes E63 sedan has several LEDs in its brake lights, as opposed to the single bulb in the old-fashioned variety, so the taillight will still work if one LED fails. **\$85,375; [mbusa.com](http://mbusa.com)**

### 2007 CADILLAC STS

The LED rear turn signals on the STS sedan are brighter than traditional bulbs, and they reach 100 percent output immediately for better visibility. **\$43,000; [cadillac.com](http://cadillac.com)**

### 2007 CADILLAC ESCALADE

LEDs in the instrument panel allow for more-precise backlighting, preventing "read through," where spillover light from a warning lamp makes one nearby also appear lit. **\$55,400; [cadillac.com](http://cadillac.com)**



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IT'S ABOUT  
TIMEWEB  
RADIO  
TO GO

Carry thousands of Internet radio stations with these portable Wi-Fi players



## THE POCKET PLAYER

The Torian InFusion doubles as an MP3 player with up to four gigabytes of SD-card memory. You can even load up songs without a computer—just set the on-board timer to record Internet radio as it plays. Enter a station using the five keys and toggle lever, or fall back on that old favorite: FM radio.

**\$230; torian.com.au**

## THE BOOMBOX

Power your picnic with radio—plus streaming podcasts and audiobooks—chosen from a scroll-through list. When the Com One Phoenix Radio finds a Wi-Fi network, it automatically updates its catalog of available stations based on what other users have added to an online database.

**\$250; com-one.biz**

**THAT 15-YEAR-OLD** AM/FM Walkman is no longer the only way to hear live, free broadcasts while you're out and about. There are more than 10,000 streaming radio stations available free over the Internet, including traditional broadcast stations restreamed online and many genre-specific Web-only options ("exercise radio," anyone?). And now, as more public spaces and even entire cities provide wireless Internet access, manufacturers are slipping Wi-Fi chips into battery-powered portable music players. So whether you're jogging or lazing around a networked park, you can tune into the perfect soundtrack.

—LAUREN AARONSON

## TORIAN INFUSION

**Size:** 2.3 x 3.0 x 0.9 in.

**Weight:** 3.5 oz.

**Batteries:** Lithium-ion

**Battery life:** 5 hrs. Wi-Fi; 8 hrs. MP3

## COM ONE PHOENIX

**Size:** 4.8 x 8.7 x 3.0 in.

**Weight:** 2 lbs.

**Batteries:** 4 rechargeable AAs

**Battery life:** 4 hrs.

## IN RELATED NEWS...

SONY VAIO WA1 WIRELESS  
DIGITAL MUSIC STREAMER

The portable WA1 doubles the fun: It streams Web radio *and* music stored on your PC. From its touchscreen, you can choose one of the thousands of channels available through *live365.com*, the largest Internet radio directory. A four-hour battery life lets you listen at any Wi-Fi hotspot. Or stay at home, where the WA1 can access and play the music on your PC. It also has a digital output port, so you can play tunes through your bass-pounding home-theater system instead of the 5.5-by-15-by-4.6-inch WA1's built-in eight-watt speakers. **\$350; sony.com**



GOOD,  
BETTER,  
BEST

# MOST DEF

With today's feature-packed camcorders, shooting high-definition home movies isn't as crazy—or expensive—as it sounds



## CANON HV20

\$1,100 (est.); [canonusa.com](http://canonusa.com)

**IDEAL FOR:** Soccer parents who want a pocket-size camera that doesn't skimp on the options

**WHY GOOD?** When you're done shooting 1080i video or snapping three-megapixel stills, the HV20's HDMI jack means it's just a one-cord connection to play back video and sound on your HD set. The HV20's 24P cinema mode mimics the 24-frames-per-second look of film and can reproduce film's smooth, warm tones. It's also the first consumer cam with a top-mounted accessory shoe that holds a shotgun mic, a video light or a camera flash.

## LITTLE-KNOWN FACT:

Standard-definition video footage looks pretty bad on high-def sets. And with the price of HDTVs falling so rapidly, it won't be long before standard-def TVs become eBay-only relics. Fortunately, there's also never been a better time to start capturing those precious home-movie

moments in HD. Even entry-level models come with a host of film-mimicking modes and controls once available only to pros. And a new top-of-the-line digital cinema model gives you enough expandability and resolution for a blockbuster shoot, at a fraction of the cost of previous models. Action!—DAN HAVLIK

## SONY HDR-FX7

\$3,500; [sonystyle.com](http://sonystyle.com)

**IDEAL FOR:** Guerrilla filmmakers who want to transition to HD without maxing out their credit card

**WHY BETTER?** A three-chip sensor, which once distinguished pros from amateurs, captures reds, greens and blues separately for more vivid color. And you can add slow-motion clips with the FX7's slow-record function, which shoots a six-second burst of video that plays back over 24 seconds. Optical image stabilization eliminates the shakes even when shooting handheld with the 20x optical zoom lens tight on the action.

BETTER



BEST

## RED ONE

\$17,500; [red.com](http://red.com)

**IDEAL FOR:** Serious moviemakers or forward-thinking wedding videographers

**WHY BEST?** Red One is the first camera under \$100,000 that can shoot 4K footage—four times the resolution consumer cams capture and crisp enough to truly replace film. Making video with its Mysterium sensor is like using a 12-megapixel digital camera to take 60 full-resolution pictures every second. Since most digital projectors can't display 4K video, Red One can also record 2K video at up to 120 frames per second (digital video is typically 60 fps). The seven-pound camera's modular design lets you configure it for your shoulder, a tripod or even a crane.



TECH  
TREND

# UNTANGLE YOUR LIFE

A new wireless technology will replace everything but the power cord

## THE TREND

Ultra-wideband, which uses low-power radio signals over a large range of frequencies, connects gadgets to your PC and to one another from 30 feet out at speeds up to 10 times as fast as Wi-Fi, with virtually no setup.

## WHY NOW

The first UWB-equipped devices arrive on shelves this year, after a long battle among chipmakers to standardize the hardware. The upshot: better compatibility among future wireless gadgets.

## WHY YOU'LL CARE

Your desktop and entertainment center won't look like a nest of cords. UWB will connect your cable box to your HDTV, your speakers to your stereo and your digital camera to your computer. It won't replace Wi-Fi, but the two will complement each other: UWB for the stuff right around you, Wi-Fi for covering a whole home or building.

—GLENN FLEISHMAN

## TOSHIBA PORTÉGÉ R400

The first computer with UWB built in, the R400 just needs to be near its wireless dock to access any peripheral, including an external monitor. Another cool feature: Two banks of superbright battery-saving LEDs light the notebook's 12.1-inch widescreen.

From \$2,600; [toshiba.com](http://toshiba.com)—SEÁN CAPTAIN

## COMING UWB GADGETS

### CAMERAS

Although Kodak hasn't announced specific UWB plans, it has shown this retrofitted V610 demo from UWB chipmaker Alereon, which can move a six-megapixel picture to your PC in less than a second. [alereon.com](http://alereon.com)



### PHONES AND PDAs

UWB will allow handheld devices to sync with your PC automatically. None have it yet, but Alereon has a prototype adapter that adds UWB to a PDA, and Stonestreet One has software that will manage wireless syncing. [stonestreetone.com](http://stonestreetone.com)



### SPEAKERS

Current wireless speaker systems use proprietary protocols for communication, but these Radients will receive sound from future UWB-equipped TVs or stereos with no extra configuration. [radient.com](http://radient.com)





Your son mentions  
enlistment and a  
million things rush  
through your head.

We're hoping one or  
two of those things  
are facts.

MAKE IT A TWO-WAY CONVERSATION. GET THE FACTS.

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AIR FORCE  
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**snowbird**

**Sunday River**



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[suzukiauto.com](http://suzukiauto.com)



Way of Life!



# HEADLINES

DISCOVERIES, ADVANCES & DEBATES IN SCIENCE



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Why NASA needs its own roller coaster



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Will Wright on *Spore*, gaming and God



**36**  
An algae-infused SUV inspired by plants

## COMMUNICATIONS

# THE DIGITAL POLYGRAPH

Researchers are developing the electronic equivalent of fiery pants: software to identify lies in cyberspace

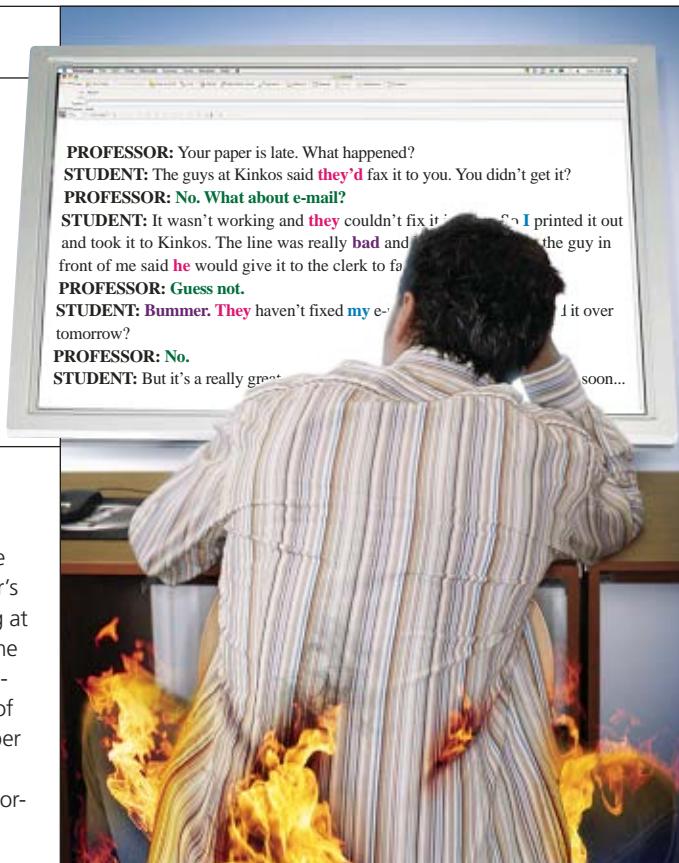
**MOST OF US TELL** one or two lies a day, according to scientists who study these things. And we rarely get caught, because the lies we tell are usually little ones: "I got stuck in traffic." "That color looks good on you." "I was just about to call."

But even the smallest fib may soon be systematically exposed, at least in the virtual world. Researchers at several universities are developing software that can detect lies in online communications such as instant messages, e-mails and chatrooms. The ability to spot "digital deception," as researchers call it, has never been more crucial. Today, much of our business and social life is conducted online, making us increasingly vulnerable. White-collar criminals, sexual predators, scammers, identity thieves and even terrorists surf the same Web as the rest of us.

Conventional lie detectors

look for physiological signs of anxiety—a bead of sweat or a racing pulse—but online systems examine only the liar's words. "When we're looking at language, we're looking at the tool of the lie," says Jeff Hancock, an assistant professor of communication and a member of the faculty of computing and information science at Cornell University.

Hancock, who recently received a \$680,000 grant from the National Science Foundation to study digital deception, says there is a growing body of evidence that the language of dishonest messages is different than that of honest ones. For example, one study led by Hancock and due to be published this spring in *Discourse Processes* found that deceptive e-mail messages contained 28 percent more words on average and used a higher percentage of words associated with negative emotions than did truthful



**PROFESSOR:** Your paper is late. What happened?  
**STUDENT:** The guys at Kinkos said **they'd** fax it to you. You didn't get it?  
**PROFESSOR:** **No. What about e-mail?**  
**STUDENT:** It wasn't working and **they** couldn't fix it. **I** printed it out and took it to Kinkos. The line was really **bad** and **the** guy in front of me said **he** would give it to the clerk to fax.  
**PROFESSOR:** **Guess not.**  
**STUDENT:** **Bummer. They** haven't fixed **my** e-mail yet. I'll have it over tomorrow?  
**PROFESSOR:** **No.**  
**STUDENT:** But it's a really great paper. I'll have it over soon...

messages. Liars also tend to use fewer first-person references (such as the pronoun "I") and more third-person references (such as "he" and "they"). This may be the liar's subconscious way of distancing himself from his lie.

More surprising, Hancock and his colleagues have observed that the targets of liars also exhibit distinctive language patterns. For instance, people who are being deceived often use shorter sentences and ask more questions. Even

▲ **SPOTTING A LIAR**  
Cornell University scientists are scanning instant messages for these telltale signs of deception:

- More third-person references [**pink**] than first-person references [**blue**]
- More words associated with negative emotions [**purple**]
- When lied to, people often use shorter sentences and ask more questions [**green**].
- When lying over e-mail or in instant messages, people tend to use 28 percent more words.

though they may not be aware that they are being lied to, people seem to exhibit subconscious suspicions.

To identify the patterns of deceit, Hancock has developed an instant-messaging system at Cornell that asks users to rate the deceptiveness of each message they send. The system has already collected 10,000 messages, of which about 6 percent qualify as patently deceptive. Eventually the results will be incorporated into software that analyzes incoming messages. If you receive a message that fits a pattern of deceptiveness, you'll get an onscreen warning that the

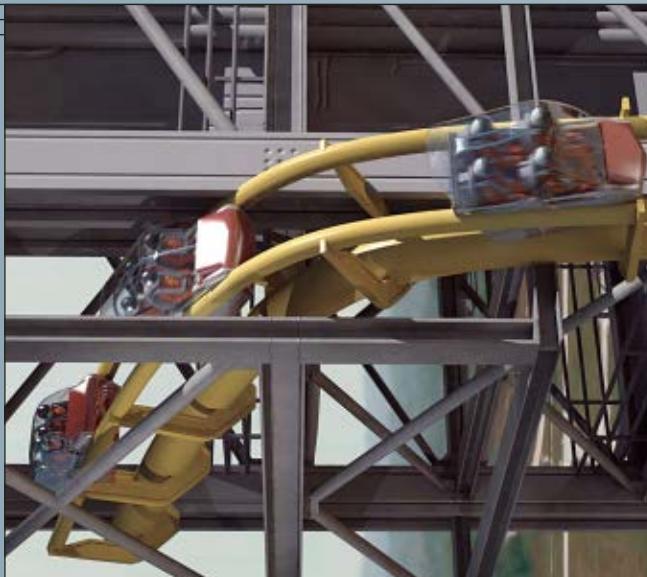
**“When we’re looking at language, we’re looking at the tool of the lie.”**

message may warrant special attention.

For now, the Cornell researchers are working only with the kinds of lies told by students and faculty. It remains to be seen whether such a system can be scaled up to handle “big” lies, such as messages sent by con artists and terrorists. “It’s very likely that lies about bomb-making are going to be different than lies about where you were on Saturday,” Hancock says.

Any future lie-detection system must be tailored to specific types of discourse, says Judee Burgoon, a communications professor and director of human-communication research at the University of Arizona’s Center for the Management of Information. A memo sent by the head of a corporation, for example, would probably be worded much differently than an online chat. “We’re only beginning to uncover how language can change when people lie,” Burgoon says.

Fortunately, the research so far suggests that people lie less often in e-mail than face-to-face or on the phone. Perhaps this is because people are reluctant to put their lies in writing, Hancock speculates. “An e-mail generates multiple copies,” he says. “It will last longer than something carved in rock.” So choose your words carefully. The Internet may soon be rid not only of deceit but also of lame excuses.—DAWN STOVER



**ALL ARMS IN!** NASA’s proposed escape coaster would reach speeds of up to 100 miles an hour. That’s fast, but the world’s fastest roller coaster, the Kingda Ka at Six Flags Great Escape Park in New Jersey, can hit 128 mph.



SPACE

## COASTING TO SAFETY

NASA eyes a launchpad escape plan nearly as thrilling as the blastoff

**IF SOMETHING GOES WRONG** in the tense moments before a space launch, such as an explosion of noxious gases or a fire on the launchpad, future astronauts could escape harm—on a roller coaster. Chris Bergin, editor of the independent Web site *NASA SpaceFlight.com*, recently unearthed a confidential NASA study of emergency egress systems (EES) in which the authors recommended using mini railcars, docked at the top of a 350-foot-tall launch tower, to speed crews down a track to ground level in a heart-pumping 4.5 seconds.

If you’re imagining astronauts screaming “Wheel!” inside their helmets with their gloved hands in the air, you’re not far off: Roller-coaster engineers served as consultants on the design, Bergin says. Other escape plans under consideration include a faster version of the current

EES for space-shuttle flights—baskets suspended from cables, which astronauts have, thankfully, never had to use—as well as a high-speed elevator and a “slide tube.”

At press time, NASA wouldn't specify a front-runner, but Kennedy Space Center's Bruce Buckingham says a new EES will be in place for the launch of the shuttle's successor, Orion, as early as 2012. That leaves plenty of time for practice runs at Six Flags. —STEPHEN HANDEL MAN

## TAKE A RIDE ON NASA'S NEW SCREAM MACHINE

### STEP 1: HOP IN AND BUCKLE UP

At the first sign of danger, astronauts dash from the crew vehicle across the top of the launch tower and buckle into an enclosed four-seat mini car. Up to four cabs would be lined up on the track to accommodate other escaping launch and rescue personnel.

### STEP 2: PREPARE TO DROP

A crew member inside unlocks the unpowered coaster from its safety catch, sending the car down a tubular track to the base of the tower. As with many modern amusement-park steel rocket “screamers,” gravity keeps the coaster wheels locked to the track, and the enclosure protects astronauts from

smoke, toxic leaks and flying debris.

### STEP 3: HOLD ONTO YOUR LUNCH

Traveling at a gravity-induced 100 mph, the cab rolls about 1,200 feet along a ground track to a safe area or bunker located inside the launch zone. A passive magnetic and friction braking system similar to those used on amusement-park rides decelerates the cabs. Total time from launchpad to bunker: about 88 seconds.

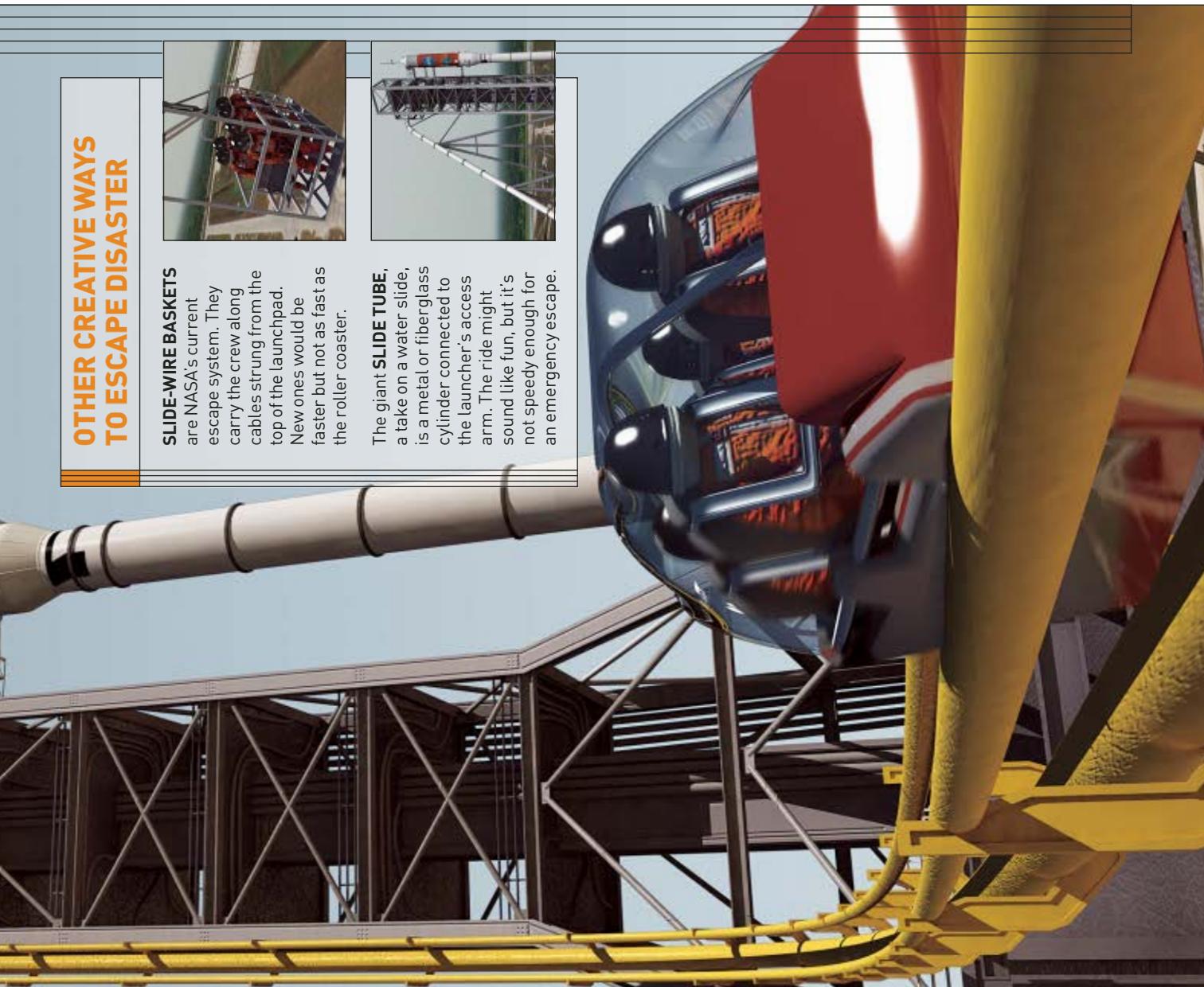
### STEP 4: RELAX

The evacuated crew exit the roller-coaster car into the safety of a covered and ventilated area, which can hold 21 people in sealed comfort for up to an hour until the danger has passed.

## OTHER CREATIVE WAYS TO ESCAPE DISASTER

**SLIDE-WIRE BASKETS** are NASA's current escape system. They carry the crew along cables strung from the top of the launchpad. New ones would be faster but not as fast as the roller coaster.

The giant **SLIDE TUBE**, a take on a water slide, is a metal or fiberglass cylinder connected to the launcher's access arm. The ride might sound like fun, but it's not speedy enough for an emergency escape.



 ODD INVENTIONS

# MOONLIGHT MAGIC

A giant moonbeam reflector may shine away depression

**IN ARIZONA'S** Sonoran Desert, 15 miles west of Tucson, the depressed and ailing come to bathe in the gentle blue-white beam of Richard Chapin's 50-foot-tall moonlight collector.

Chapin, the founder of a lucrative Arizona swap meet, has spent the past four years and \$2 million of his personal fortune building the world's first and only therapeutic moonbeam catcher, a 30-ton array of mirrors called the Interstellar Light Collector. Although he has no medical training, Chapin is convinced that his invention can help people conquer depression, arthritis and even some types of cancer.

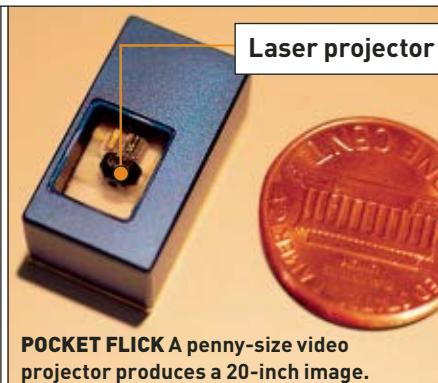
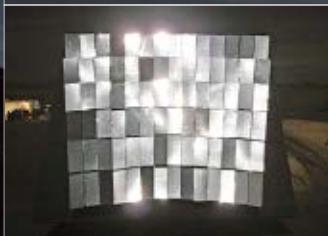
He has only anecdotal evidence to back his claims, however, so he's invited scientists nationwide to put his device to the test. Biologists at the University of Arizona have expressed interest in using the collector to study moonlight's effects on plant growth cycles but not yet on people. If nothing else, the collector offers a unique

research opportunity. Although moonlight is reflected sunlight, its frequency and spectrum are unique and, so far, irreplicable, which makes it difficult to examine in a controlled, clinical fashion. "It's a hot area to understand the spectral effects of light on human health and physiology," says Michael Gorman, a University of California at San Diego biopsychologist who has studied how hamsters react to light.

Chapin—who spends many a late night, especially during a full moon, tinkering with his reflector—plans this year to test moonbeams' effects on animals with cancer. But already a few human volunteers have subjected themselves to Chapin's moonlight. One woman claims the session eliminated her need for eyeglasses; another volunteer says it cleared up her rash. Chapin contends that, hogwash or not, the results at least merit follow-up research: "That's why we're getting started."—ALAN M. PETRILLO

## HOW IT WORKS

The collector's 84 mirrors move as a single unit that can rotate 360 degrees. By adjusting each mirror individually, the reflected moonbeams can be focused onto an area as big as a pickup truck or as small as a person's head.



Laser projector

**POCKET FLICK** A penny-size video projector produces a 20-inch image.

 **SHRINKAGE**  
THE QUEST TO MAKE REALLY TINY THINGS

## THE WORLD'S SMALLEST PROJECTOR

New research turns your PDA into a movie theater

### THE FRAUNHOFER INSTITUTE

helped make our music collections pocket-size by inventing MP3 compression, and now it's made video equally mobile. Researchers at the German think tank have crammed a video projector into a box about the size of a sugar cube. This feat of miniaturization could be the first step toward portable gadgets that project big-screen images wherever you go.

In traditional digital projectors—the kind you might find in a conference room or home theater—microscopic mirrors tip back and forth to switch individual pixels on or off. A typical projector requires nearly 800,000 mirrors and a single lamp large enough to illuminate the entire array, all of which add bulk to its frame. The researchers' mass-shedding trick was to use a single mirror just two hundredths of an inch in diameter. Instead of remaining stationary, the mirror does the job of many by rapidly tilting in two directions, projecting individual pixels across the screen in an oscillating wave that converges to complete a 20-inch image.

Microvision, an imaging company in Redmond, Washington, has incorporated the technology in a tiny prototype projector that debuted in January.—ERIC MIKA

# THE SLEEP YOU'VE BEEN DREAMING OF.



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It's what you've been craving. Peaceful sleep without a struggle. That's what LUNESTA® is all about: helping most people fall asleep quickly, and stay asleep all through the night. It's not only non-narcotic, it's approved for long-term use. So you can feel comfortable taking it night after night. Talk to your doctor first before using sleep aids for extended periods. Tonight, just close your eyes, and *leave the rest to Lunesta.*

Find out how to improve your sleep habits at [www.lunesta.com](http://www.lunesta.com). Or call 1-800-Lunesta.

**IMPORTANT SAFETY INFORMATION:** LUNESTA works quickly, and should be taken right before bed. Be sure you have at least eight hours to devote to sleep before becoming active. Until you know how you'll react to prescription LUNESTA, you should not drive or operate machinery. Do not use alcohol while taking LUNESTA. Most sleep medicines carry some risk of dependency. Side effects may include unpleasant taste, headache, drowsiness and dizziness. See important patient information on the next page.

**Lunesta**<sup>®</sup>  
(eszopiclone)<sub>c</sub>  
1, 2 AND 3 MG TABLETS



Please read this summary of information about LUNESTA before you talk to your doctor or start using LUNESTA. It is not meant to take the place of your doctor's instructions. If you have any questions about LUNESTA tablets, be sure to ask your doctor or pharmacist.

LUNESTA is used to treat different types of sleep problems, such as difficulty in falling asleep, difficulty in maintaining sleep during the night, and waking up too early in the morning. Most people with insomnia have more than one of these problems. You should take LUNESTA immediately before going to bed because of the risk of falling.

LUNESTA belongs to a group of medicines known as "hypnotics" or, simply, sleep medicines. There are many different sleep medicines available to help people sleep better. Insomnia is often transient and intermittent. It usually requires treatment for only a short time, usually 7 to 10 days up to 2 weeks. If your insomnia does not improve after 7 to 10 days of treatment, see your doctor, because it may be a sign of an underlying condition. Some people have chronic sleep problems that may require more prolonged use of sleep medicine. However, you should not use these medicines for long periods without talking with your doctor about the risks and benefits of prolonged use.

#### Side Effects

All medicines have side effects. The most common side effects of sleep medicines are:

- Drowsiness
- Dizziness
- Lightheadedness
- Difficulty with coordination

Sleep medicines can make you sleepy during the day. How drowsy you feel depends upon how your body reacts to the medicine, which sleep medicine you are taking, and how large a dose your doctor has prescribed. Daytime drowsiness is best avoided by taking the lowest dose possible that will still help you sleep at night. Your doctor will work with you to find the dose of LUNESTA that is best for you. Some people taking LUNESTA have reported next-day sleepiness.

To manage these side effects while you are taking this medicine:

- When you first start taking LUNESTA or any other sleep medicine, until you know whether the medicine will still have some effect on you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
- Do not drink alcohol when you are taking LUNESTA or any sleep medicine. Alcohol can increase the side effects of LUNESTA or any other sleep medicine.
- Do not take any other medicines without asking your doctor first. This includes medicines you can buy without a prescription. Some medicines can cause drowsiness and are best avoided while taking LUNESTA.
- Always take the exact dose of LUNESTA prescribed by your doctor. Never change your dose without talking to your doctor first.

#### Special Concerns

There are some special problems that may occur while taking sleep medicines.

##### Memory Problems

Sleep medicines may cause a special type of memory loss or "amnesia." When this occurs, a person may not remember what has happened for several hours after taking the medicine. This is usually not a problem since most people fall asleep after taking the medicine. Memory loss can be a problem, however, when sleep medicines are taken while traveling, such as during an airplane flight and the person wakes up before the effect of the medicine is gone. This has been called "traveler's amnesia." Memory problems have been reported rarely by patients taking LUNESTA in clinical studies. In most cases, memory problems can be avoided if

you take LUNESTA only when you are able to get a full night of sleep before you need to be active again. Be sure to talk to your doctor if you think you are having memory problems.

##### Tolerance

When sleep medicines are used every night for more than a few weeks, they may lose their effectiveness in helping you sleep. This is known as "tolerance." Development of tolerance to LUNESTA was not observed in a clinical study of 6 months' duration. Insomnia is often transient and intermittent, and prolonged use of sleep medicines is generally not necessary. Some people, though, have chronic sleep problems that may require more prolonged use of sleep medicine. If your sleep problems continue, consult your doctor, who will determine whether other measures are needed to overcome your sleep problems.

##### Dependence

Sleep medicines can cause dependence in some people, especially when these medicines are used regularly for longer than a few weeks or at high doses. Dependence is the need to continue taking a medicine because stopping it is unpleasant.

When people develop dependence, stopping the medicine suddenly may cause unpleasant symptoms (see *Withdrawal* below). They may find they have to keep taking the medicine either at the prescribed dose or at increasing doses just to avoid withdrawal symptoms.

All people taking sleep medicines have some risk of becoming dependent on the medicine. However, people who have been dependent on alcohol or other drugs in the past may have a higher chance of becoming addicted to sleep medicines. This possibility must be considered before using these medicines for more than a few weeks. If you have been addicted to alcohol or drugs in the past, it is important to tell your doctor before starting LUNESTA or any sleep medicine.

##### Withdrawal

Withdrawal symptoms may occur when sleep medicines are stopped suddenly after being used daily for a long time. In some cases, these symptoms can occur even if the medicine has been used for only a week or two. In mild cases, withdrawal symptoms may include unpleasant feelings. In more severe cases, abdominal and muscle cramps, vomiting, sweating, shakiness, and, rarely, seizures may occur. These more severe withdrawal symptoms are very uncommon. Although withdrawal symptoms have not been observed in the relatively limited controlled trials experience with LUNESTA, there is, nevertheless, the risk of such events in association with the use of any sleep medicine.

Another problem that may occur when sleep medicines are stopped is known as "rebound insomnia." This means that a person may have more trouble sleeping the first few nights after the medicine is stopped than before starting the medicine. If you should experience rebound insomnia, do not get discouraged. This problem usually goes away on its own after 1 or 2 nights.

If you have been taking LUNESTA or any other sleep medicine for more than 1 or 2 weeks, do not stop taking it on your own. Always follow your doctor's directions.

##### Changes In Behavior And Thinking

Some people using sleep medicines have experienced unusual changes in their thinking and/or behavior. These effects are not common. However, they have included:

- More outgoing or aggressive behavior than normal
- Confusion
- Strange behavior
- Agitation
- Hallucinations
- Worsening of depression
- Suicidal thoughts

How often these effects occur depends on several factors, such as a person's general health, the use of other medicines, and which sleep medicine is being used. Clinical experience with LUNESTA suggests that it is rarely associated with these behavior changes.

It is also important to realize it is rarely clear whether these behavior changes are caused by the medicine, are caused by an illness, or have occurred on their own. In fact, sleep problems that do not improve may be due to illnesses that were present before the medicine was used. If you or your family notice

any changes in your behavior, or if you have any unusual or disturbing thoughts, call your doctor immediately.

##### Pregnancy And Breastfeeding

Sleep medicines may cause sedation or other potential effects in the unborn baby when used during the last weeks of pregnancy. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, or if you become pregnant while taking LUNESTA.

In addition, a very small amount of LUNESTA may be present in breast milk after use of the medication. The effects of very small amounts of LUNESTA on an infant are not known; therefore, as with all other prescription sleep medicines, it is recommended that you not take LUNESTA if you are breastfeeding a baby.

##### Safe Use Of Sleep Medicines

To ensure the safe and effective use of LUNESTA or any other sleep medicine, you should observe the following cautions:

1. LUNESTA is a prescription medicine and should be used ONLY as directed by your doctor. Follow your doctor's instructions about how to take, when to take, and how long to take LUNESTA.
2. Never use LUNESTA or any other sleep medicine for longer than directed by your doctor.
3. If you notice any unusual and/or disturbing thoughts or behavior during treatment with LUNESTA or any other sleep medicine, contact your doctor.
4. Tell your doctor about any medicines you may be taking, including medicines you may buy without a prescription and herbal preparations. You should also tell your doctor if you drink alcohol. DO NOT use alcohol while taking LUNESTA or any other sleep medicine.
5. Do not take LUNESTA unless you are able to get 8 or more hours of sleep before you must be active again.
6. Do not increase the prescribed dose of LUNESTA or any other sleep medicine unless instructed by your doctor.
7. When you first start taking LUNESTA or any other sleep medicine, until you know whether the medicine will still have some effect on you the next day, use extreme care while doing anything that requires complete alertness, such as driving a car, operating machinery, or piloting an aircraft.
8. Be aware that you may have more sleeping problems the first night or two after stopping any sleep medicine.
9. Be sure to tell your doctor if you are pregnant, if you are planning to become pregnant, if you become pregnant, or if you are breastfeeding a baby while taking LUNESTA.
10. As with all prescription medicines, never share LUNESTA or any other sleep medicine with anyone else. Always store LUNESTA or any other sleep medicine in the original container and out of reach of children.
11. Be sure to tell your doctor if you suffer from depression.
12. LUNESTA works very quickly. You should only take LUNESTA immediately before going to bed.
13. For LUNESTA to work best, you should not take it with or immediately after a high-fat, heavy meal.
14. Some people, such as older adults (i.e., ages 65 and over) and people with liver disease, should start with the lower dose (1 mg) of LUNESTA. Your doctor may choose to start therapy at 2 mg. In general, adults under age 65 should be treated with 2 or 3 mg.
15. Each tablet is a single dose; do not crush or break the tablet.

**Note: This summary provides important information about LUNESTA. If you would like more information, ask your doctor or pharmacist to let you read the Prescribing Information and then discuss it with him or her.**

##### Rx only



WHAT'S THE BIG  
IDEA?

# THE WRIGHT STUFF

Will Wright tackles life, the universe and everything in *Spore*



**ALTHOUGH GAMING** is a multibillion-dollar business rivaling the movie industry, the creative talents behind it slave away in near anonymity. Will Wright is the rare exception, a 47-year-old superstar developer responsible for the creation of millions of virtual cities and people through his best-selling Sim titles (*Sim City*, *The Sims* and *The Sims 2*). He's poured seven years into his next project, the ambitious videogame *Spore*, due to ship this fall, in which players pilot the development of life from a single cell to an intergalactic empire. We joined him for lunch in New York City to chat about his magnum opus, evolution, and why videogames of the future will play us as much as we play them.

—STEVE MORGENSTERN

**Q: *Spore* is one of the most complex games ever developed, but can you describe it in 60 words or less?**

**A:** The core of it is, we want the players to create their own world. At

every level, you manipulate a simulation of life, society, civilization and exploration. And as you create each level, it's automatically shared with other players, so that people playing their own game are also creating the game worlds for everybody else.

**Q: How much is the game based on established scientific theory?**

**A:** I think the rough arc of life in the game is a pretty accurate, though caricatured, representation of reality in the way life evolved from single cell to multicell to intelligence. In the evolution part of the game, the player is actually designing the creature, so in fact it's more like intelligent design rather than pure evolution.

**Q: Do you subscribe to the theory of intelligent design?**

**A:** Personally, I'm a hardcore evolutionist, but intelligent design makes the game more fun. I think

people love controlling their experience, creating everything, playing out stories, and having the ultimate power to shape the experience and environment however they want.

**Q: The content-sharing system is one of the most innovative parts of the game. Can you explain how that works?**

**A:** Every time the player makes something in the game—creature, building, vehicle, planet, whatever—it gets sent to our servers automatically. As players need to populate their game with other creatures in the evolution game, other cities in the civilization game, other planets and races and aliens in the space game, those are actually coming from our server and were created by other players. So there's an infinite variety.

**Q: Do you see *Spore* as educational?**

**A:** I think in a way, yes. But not in a

**MR. UNIVERSE** In Will Wright's new game *Spore*, players can create more than two million planets.



curriculum-based, I'm-going-to-teach-you-facts kind of way. I think more in terms of deep lessons in problem-solving, or just creativity. Creativity is a fundamental of education that's not really taught very much. But we're giving people tools, and what it means to be human is to learn to use tools to expand your abilities. I think computer games are in some sense a fundamental tool for our imagination. They're about problem-solving and interacting with things in an unstructured way.

**Q: Where are videogames in the course of *their* evolution?**

**A:** One thing that really excites me, that we're doing just a little bit of in *Spore*, is the way the computer is kind of looking at what you do and developing a model of the player. I think that's going to be a fundamental game feature about 10 years from now. Games will inherently observe you and then customize their dif-



**WILD THINGS** Creatures in *Spore* band together to ward off predators.

**“Computer games are in some sense a fundamental tool for our imagination.”**

ficulty, goal structures, stories and so on relative to every player. You and I might buy the same game one day and, a month later, our games are almost unrecognizably different because yours has evolved to fit and entertain you, and mine has evolved to fit and entertain me. So it becomes kind of like the ultimate playmate.

**Q: Any danger of kids losing interest in real playmates?**

**A:** I don't think so. Videogames can be a very intelligent and social experience. Just watching kids together in front of their game consoles, it's amazing how much intense socialization they go through. It ends up being a bonding experience.

essential<sub>2</sub>th

POLICE

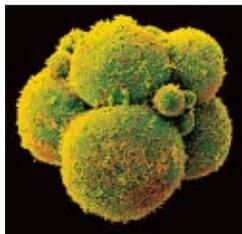
 THE EQUATION

# DESKTOP ORGAN PRINTER

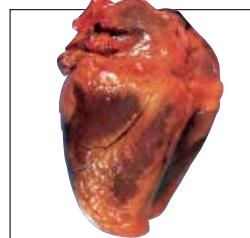
Tissue engineers are raiding the office supply closet to build better body parts



**INKJET PRINTER**



**STEM CELLS**



**BETTER HEART**

**STEM CELLS MAY BE SPARKING** a medical revolution, but their magical ability to morph into any tissue type is hard to control. Take the cells out of their natural habitat, and they behave like ambivalent job-seekers, unable to settle into a single role as, say, bone or heart cells. Now Carnegie Mellon University researchers are turning to the humble inkjet printer to make them commit. In the body, stem cells take their marching orders from proteins called growth

factors, which determine what type of tissue stem cells will become. Carnegie Mellon's bioprinter sprays growth factor directly onto tissues in patterns that mimic its natural distribution in the body and dictate stem cells' growth. "Eventually," says researcher Julie Phillippi, "we want to print these growth factors layer by layer to repair multiple tissue types—bone, muscle, cartilage." The wait for patients? At least a decade, Phillippi says.—ELIZABETH SVOBODA

FROM LEFT: CORBIS; DR. YORGOS NIKAS/PHOTO RESEARCHERS; PETER SILUGETTY/IMAGES

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essential

## BIGGER, BETTER, FASTER

# OVERACHIEVERS WE LOVE

The Panama Canal supersized, an algae-infused Hummer and an almost light-speed Internet

## BIGGER

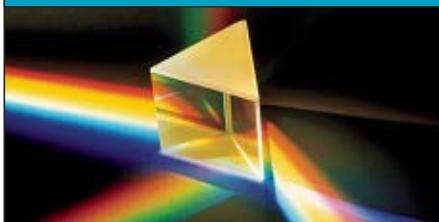


**LOG JAM** Behemoth ships clog the canal.

### PANAMA CANAL 2.0

Ships sometimes wait days to pass through the Panama Canal, and container vessels are increasingly built to lengths of 1,100 feet or longer, far beyond the canal's 965-foot limit. The solution? Double its capacity with a \$5.2-billion project to widen and deepen the existing channel, and build a third set of fully computerized locks—chambered structures that lift ships into the canal 89 feet above sea level—due to open in 2014.

## FASTER



**BRILLIANT** Slow down light, surf faster.

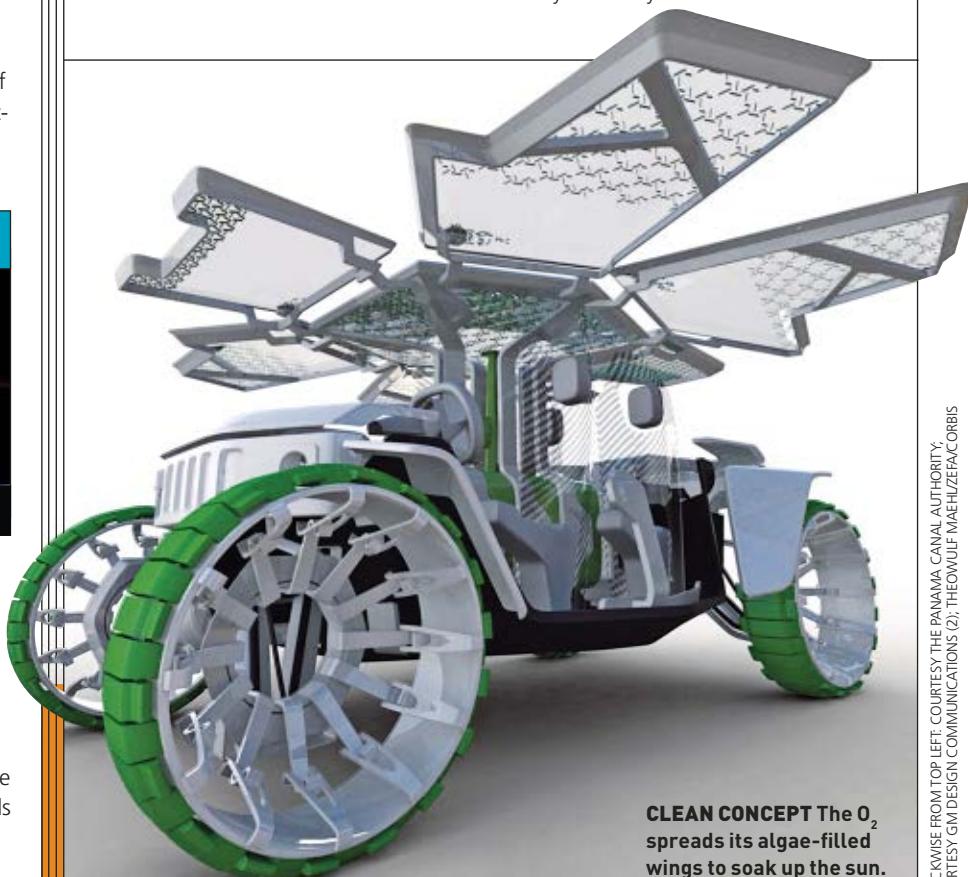
### SHINE ON YOU CRAZY INTERNET

Scientists at Sydney University in Australia have slowed the speed of light by 16 percent, the first step toward an all-optical Internet that's 1,000 times as fast as today's Web. The problem nowadays? The clunky electrical circuits required to convert light pulses to electrical signals. Optical circuits are much faster but work best when light travels slower than its normal speed of 186,000 miles per second.—JEBEDIAH REED

## BETTER

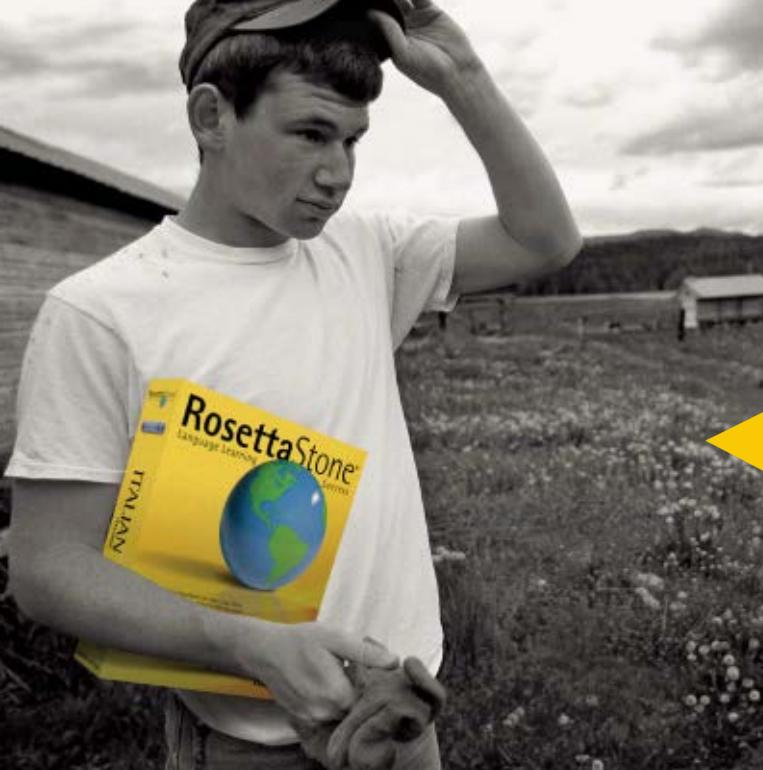
### THE CHIA PET HUMMER

A General Motors design team believes that by 2016, the Hummer could be nearly as environmentally friendly as a plant. The hydrogen-powered concept vehicle Hummer O<sub>2</sub> would feature body panels filled with a pleasingly green mixture of water and algae that would mimic the air-cleaning process of photosynthesis. A computer would automatically tilt the phototropic panels to collect the greatest amount of sun, so even while parked, the SUV would "breathe," absorbing carbon dioxide and converting it to pure oxygen (hence the vehicle's name) just as plants do, and releasing it into the atmosphere through two-way valves. Topping off the Hummer O<sub>2</sub>'s green credentials are shape-shifting tires that adjust to the curve of the road to maximize fuel efficiency, and the fact that the vehicle is constructed entirely from recycled materials.



**CLEAN CONCEPT** The O<sub>2</sub> spreads its algae-filled wings to soak up the sun.

CLOCKWISE FROM TOP LEFT: COURTESY THE PANAMA CANAL AUTHORITY; COURTESY GM DESIGN COMMUNICATIONS (2); THEOWULF MAEHLZ/ZEFA/CORBIS



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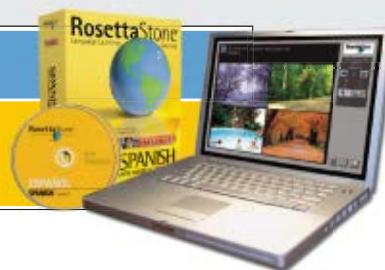
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## ANTI-TERROR TECHNOLOGY

# BUGGING OUT ON HOMELAND SECURITY



Wings, antennae and scales may be our best weapons yet against toxins and explosives

**ANNOYING AS THEY ARE**, you may want to think twice before you crush a cockroach or swat a fly—you could be killing a future foot soldier in the war on terror. Increasingly, scientists are turning to insects and other creatures for better ways to identify biohazards. “Cockroaches can detect all kinds of things, from anthrax spores to DNA,” says Karen Kester, an entomologist at Virginia Commonwealth University. With \$1 million in funding from the Pentagon’s Defense Advanced Research Projects Agency (Darpa), Kester is studying ways to use roaches and houseflies as toxin sentinels inside contaminated buildings or subways. This, of course, spares humans the job, and it may

prove more effective than mechanical sensors, which often lack the range and sensitivity of their living counterparts.

Bees and fish are also in demand. A small British biotechnology firm called Inscintinel is employing the finely tuned olfactory system of bees to sniff for explosives. And New York, California and Maryland are exploiting the highly sensitive nervous system of bluegill fish to test for toxins in municipal water supplies. Bill Lawler, co-founder of Intelligent Automation Corporation, the California company that sells the bluegill-monitoring system, says living sensors are “the wave of the future.” So go easy on the Raid.—ABBY SEIFF

LIVING SENSORS	WHY WE NEED THEM	HOW THEY WORK	DEPLOYMENT	DRAWBACKS
<b>BLUEGILL FISH</b> 	Waterborne parasites sicken some 900,000 Americans every year, and public reservoirs are highly vulnerable to terrorist attack.	Slight impurities drive big changes in bluegills’ vitals. Sensors in the tank monitor the fish and sound an alarm when things get out of whack.	The fish stand guard at reservoirs in New York, California and Maryland, where they’ve detected pesticides and a diesel spill.	Bluegills respond indiscriminately to a broad range of contaminants, so technicians must follow up with other tests to pinpoint specific hazards.
<b>WASPS AND BEES</b> 	One bomb-sniffing dog can cost upward of \$15,000 to train. A bee system is just as accurate and costs pennies per bee.	When bees detect the target odor, they extend their proboscises. A camera records the positive response, and a computer alerts an operator.	British biotech firm Inscintinel hopes to commercialize its system by next year.	Although the bees are sealed in a container, inviting them into an airport could make travelers a bit nervous.
<b>ROACHES AND FLIES</b> 	Despite the anthrax scare of 2001, there’s still no efficient mechanized way to comb a building for biohazards. Insects unwittingly absorb environmental impurities every day.	In an emergency, workers could release roaches in a building, or collect bugs already there, and test them for toxins to determine the next step.	Darpa-funded Karen Kester, the principal player in this line of research, says a roach-based detection system could be ready within a few years.	Bugs are easy to trap and test for pathogens, but it’s difficult to control where they run once released.
<b>BUTTERFLIES AND MOTHS</b> 	Robotics can’t yet mimic insects’ flying abilities, so scientists are developing controllable cyborg butterflies that could fly sample-collection missions through buildings.	A chip, implanted during the pupal stage, could control locomotion, monitor the air, and override instincts to feed, mate, and avoid certain environments.	Darpa has solicited public proposals but hasn’t announced a winner. Scientists are in the early stages of research; a final product is years away.	Implanting a chip in a developing insect could stunt its growth and damage its ability to fly as an adult.

FROM TOP: BEE: SCOTT CAMAZINE/PHOTO RESEARCHERS; RIFLE AND HARD HAT: GETTY IMAGES; EDWARD KINSMAN/PHOTO RESEARCHERS; CHARLES NESBIT/GETTY IMAGES; DAVIES & STARR/GETTY IMAGES; GAIL SHUMWAY/GETTY IMAGES

*"As a professional restorer of antique and classic watches for museums, including the Smithsonian, I recently reviewed the movement and individual parts of the Stauer 1779 Skeleton watch. The assembly and the precision of the mechanical movement are excellent."*

*—George Thomas  
Towson Watch Company*



## No Bones About It

*The Vintage Design of the Stauer 1779 Skeleton Reveals the Precision Inner Workings of a Great Machine.*

We found our most interesting watch in our oldest history book. A trip to an antique book store led us to find one of the earliest designs of the sought after skeleton timepiece. With a 227-year-old design, Stauer has brought back the past in the intriguing old world geometry of the Stauer 1779 Skeleton. See right through to the precision parts and hand assembled movement and into the heart of the unique timepiece. It's like seeing an X-Ray inside the handsome gold filled case.



*The open exhibition back allows you to further explore the intricate movement and fine craftsmanship.*

**Beauty is only skin deep but the Engineering Goes Right to the Bone.** Intelligent Collectors of vintage mechanical watches have grown bored with mass produced quartz movements. Like fine antique car collectors, they look for authenticity, but they also want practicality from their tiny machines. Inspired by a rare museum piece dating to 1779, we engineered this classic with \$31,000,000 worth of precise Swiss built machinery to create the intricate gears and levers. So the historians are thrilled with the authenticity and the demanding engineers are quite impressed with the technical performance.

**See All the Way Through.** The crystal on the front and the see through exhibition back allow you to observe the gold-fused mainspring, escapement, balance wheel and many of the 20 rubies work in harmony. The balance wheel oscillates at 21,600 times per hour for superb accuracy. The crocodile embossed leather strap adjusts from 6 1/2" to 9" so it will fit practically any wrist. So give it a little wind and the gears roar to life.

**The Time Machine.** We took the timepiece to George Thomas, a noted historian and watch restorer for museums

such as the Smithsonian, and he dissected the 110 parts of the vintage movement. He gave the "1779" top reviews. "It is possible to build it better than the original, and your new skeleton requires so little maintenance." When we shared the price with him, George was stunned. He said that no other luxury skeleton can be had for under \$1000. But we pour our money into the watch construction, not into sponsoring yacht races and polo matches. We have been able to keep the price on this collector's limited edition to only three payments of \$33.00. So

you can wear a piece of watch making history and still keep most of your money in your pocket, not on your wrist. This incredible watch has an attractive price and comes with an exclusive 30-day in-home trial. If you're not completely satisfied with the performance and exquisite detail of this fine timepiece, simply return it for a full refund of your purchase price. There are only 4,999 in the limited edition, so please act quickly. Historical value rarely repeats itself.

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# NO MORE MO

Sometimes we all hate our jobs. The soulless grid of cubicles, the after-lunch fatigue, the doing the same thing over and over again until you just want to . . . well, we know how it is. But hang in there. In a few short years, your chair will nestle against you,





**THEN** Twentieth-century ideas about efficiency emphasized isolation and uniformity. That's why work sucks.

# NDAY BLUES

the office will be open and light-filled, and your work pals will be Scots, Argentinians and Chinese on the other side of a hyper-realistic videoconference you'll access from the kitchen. Technology arriving now will soon make you look forward to Monday.



**NOW** Twenty-first-century ideas center on light, openness and sociability. That's why work won't suck in the future.



# WORKERS OF THE WORLD,

Realistic videoconferencing is the single most important development in the future of the workplace, and it's already begun to arrive. Prepare to face the boss

**ALEXANDER GRAHAM BELL** had it right from the beginning. "Mr. Watson," he called to his assistant through the first working telephone, "come here—I want to see you." Fifty years later, the first television transmission made his words literal. And now, 130 years later, the pieces are falling into place to finally let us all be seen. The promise of a video telephone has been around for years, of course. But now the essential factors are truly in place to give you the digital equivalent of a face-to-face experience with co-workers thousands of miles away. And of all the advancements you'll see in your workplace over the next 10 years, realistic videoconferencing is the one that will change everything.

Existing graphics-processing power

and bandwidth already make videoconferencing possible. What will make it intuitive and effective is sophisticated, low-cost camera technology and flexible, dynamic video screens. Next-generation videoconferencing isn't like today's monitor-size peephole to a tiny, jerky, muffled slice of life. It's rich enough to capture all the gestures, expressions and other essentials of human communication.

"It's an emotional and physical link between us," says Hewlett-Packard research scientist Mark Gorzynski, shaking his head at the thought—which I know because I can see him doing it on the high-definition video screen in front of me. I'm at HP Labs in Palo Alto, California; Gorzynski is in Corvallis, Oregon. But we're "together"

in HP's Halo Collaboration Studio, a setup the company introduced a year ago. (Cisco debuted a competing system last month.) Each Halo room is, in effect, half of a beige conference room, linked to any other identical-looking Halo room by four 60-inch plasma screens, an echo-free audio system, and a proprietary, low-latency, superfast data network. The sound is good enough to have multiple simultaneous conversations across the table, and I repeatedly forget that there's a lot more than a table between us. HP has installed 75 Halo rooms around the world: an early one for Jerry Seinfeld, who is producing his new animated movie from a Halo room in his New York office linked to Dreamworks's California studio, and the rest mainly for pharmaceutical and financial-

PRECEDING PAGES: PHOTOGRAPH (TOP): WALTER HODGES/GETTY IMAGES; ILLUSTRATION (BOTTOM): PETER BOLLINGER; THIS AND FACING PAGE: ILLUSTRATION: GRAHAM MURDOCH; PHOTOGRAPH: GETTY IMAGES (6)



**GANG'S ALL HERE**  
Cutting-edge videoconferencing is already realistic. Soon it will incorporate eye contact, portability and integrated information.

# UNITE!

services companies, which must constantly communicate with a far-flung sales force.

Halo remains expensive (\$500,000 per room) and clunky. You can't pace around or carry it home. But as its popularity grows, it will become both more useful and more intuitive. As Robert Metcalfe, the inventor of Ethernet, formulated, the value of a telecommunications network increases exponentially with the number of users in the network. It took only a decade for e-mail and cellphones to go from novelty to global ubiquity. Once videoconferencing is as seamless as a phone call, our innate sociability will kick in and make it instinctive. Perhaps you already check your e-mail before work. Soon you may also pop into the office virtually before actually arriving.

Back at HP labs, a group of researchers sit me down in front of a large, curved movie screen. Desktop windows begin popping up. In one corner, a regular Windows XP desktop appears against a black backdrop, then a videoconferencing window, then another—all seamlessly thrown on the screen by three carefully aligned off-the-shelf LCD projectors. On cue, the images begin resizing and circling each other. I stare at a computer screen all day, but this is like being inside the IMAX version. On this sort of wall-size monitor, "something magical happens when you fill the field of view," says HP researcher Bruce Culbertson with a chuckle. And the video feed is running off an ordinary PC.

In an adjacent room, the HP scientists

show off a prototype "fan camera"—an array of 22 cheap cellphone cams, all attached to a single mount about the size and shape of a soup bowl. The individual video feeds are then stitched into a single panoramic image, allowing the camera to pan without any mechanical movement.

Finally, Culbertson punches at a keypad, and a heavy door clicks open. Waiting for us inside is Dave Nguyen. Kind of. He's actually in Berkeley, 40 miles away, but his 3-D image is before us, projected on a flat screen coated with electro-reflective material, like the type used on highway road signs, that replaces the need for special glasses. The image is a bit blurry, and I have to stay still in just the right spot, but the setup pulls off a trick no current videoconferencing system can do: eye contact.

We play a quick game. Nguyen looks at one of the three of us sitting on this side of the screen, and the recipient of his gaze raises his hand. It works. As Nguyen shifts his eyes among us, we each raise a hand, as if saluting our future.—ANDREW BLUM

**CUBE NO MORE** An open, organic design, along with privacy-saving technology, will make desks a pleasant place to sit.



# EMPLOYEE LOUNGE

Kiss the cube farm goodbye. In a decade, the place you work will be as comfortable as a chair in your neighborhood coffee shop, while the tech will preserve your privacy **BY PETER HALL**

**"I CAN'T REMEMBER** the last time I had a great idea at my desk," says Robert King, the CEO of Humanscale, which manufactures ergonomic office equipment. King, like every major manufacturer or designer involved in the modern office, is seeing a shift away from the grid of six-by-eight-foot cubicles and toward the casual office "landscape" that designers and efficiency experts agree will soon be the paradigm. If you've been in a Starbucks, you've got a rough idea of what's coming. But in your future office, while you enjoy the open, airy feeling of a casual café, sophisticated technology will be invisibly supporting your need for privacy and concentration.

The reason for the shift is simple: More people share workspaces with other employees (a recent survey commissioned by the furniture giant Steelcase put the figure at 37 percent) and spend more time working out of the office. College enrollment stats predict more women (who tend to involve more co-workers in decision-making) than men in the white-collar workplace of the future. After a 40-year reign, the building block of the traditional office—the cubicle—looks like it's going the way of the typewriter and the Rolodex.

Highly flexible furniture systems are already taking its place. Swiss manufacturer Vitra's new Level 34 is a bench-based

modular system with quickly detachable seats, cabinets and shelving that foreshadow an era of itinerant workforces that collaborate briefly but intensively, like film production crews. For extra flexibility, Level 34 provides built-in wiring channels. Zeeland, Michigan-based manufacturer Herman Miller is placing its hopes on a programmable data and electrical infrastructure called Convia, which allows office dwellers to wirelessly reconfigure and network their space with an infrared remote control. When Wi-Fi is secure enough to be ubiquitous in offices, King says, less networking means "desks are going to be simpler and smaller [because] they



**CHOOSE YOUR SPOT** Irregular layouts let the room breathe.

## TECHNOLOGY FOR THE OPEN OFFICE



**SOUND MASKING** Connected to your landline, the Babble device records your end of the call and emits a duplicated scramble of your voice and others via speaker to obscure your conversation within a low murmur of cocktail-party chatter. "It turns you into a small crowd," says Sonare Technologies president Bill DeKruif.



**PRIVACY GLASS** Liquid crystals have the fluidity of a liquid but the ordered structure of a solid. In privacy glass, applying an electrical charge causes the molecules to switch from a random, light-admitting arrangement to an orderly, light-blocking one.



**MODULAR FURNITURE** Systems like Vitra's Level 34 offer an infinite variety of work areas without altering the physical substance of the building. The components can be transformed into straight lines, T-shapes, L-shapes or octagons, allowing for collaborative work at a moment's notice.

won't need to hold up big computers."

Flatter, lighter display screens will also allow workers to plug in to any number of screens in the workplace. The Holopro projection screen, from German firm Pronova, uses a photographic film between two sheets of glass that, when illuminated by a laser, generates thousands of holographic optical elements that redirect the light of a projector back toward the viewer, producing a clear image regardless of light conditions. Dennis Gaffney, a vice president at Baltimore-based architecture firm RTKL, has proposed using Holopro for the glass partitions between workstations. "It can be transparent, or you can use it to project photos of your kids or what's on your laptop screen," he says.

In an open, light-filled workplace full of impromptu meetings, of course, the most endangered characteristic is privacy. "Group space will be more important than personal space," says Cameron Campbell, a Herman Miller designer, but people will still need a corner they can call their own.

The subtle details of the future office preserve the ability to work in isolation. Products such as Polytronix Privacy Glass, initially developed at Kent State University, make it possible for an executive anticipating an incognito meeting to press a switch to turn the walls in her glassed-in

office opaque; electrical current through an epoxy-based liquid crystal realigns the molecules to scatter light. For delicate conversations, new sound-masking technology is coming on the market that counteracts the confidentiality hazards of a more open, casual office. Sonare Technologies, a Herman Miller company, recently introduced a tool called Babble that scrambles the sound of your voice and transmits it over a speaker to render your words nonsensical to eavesdroppers. Less distracting is a ceiling-mounted noise generator such as Cambridge Sound Management's Oasis system of small speakers that issue a sound-masking *whoosh* not unlike the sound of an air conditioner.

With all this tech for protecting your privacy, office habits will have to evolve. Steelcase recently unveiled a collection of furniture that offers acoustical solitude, from a "cell cell" (a hanging tent for private calls) to an acoustical-tile fabric "echo wall." The problem with dedicated privacy spaces, of course, is that merely wandering into one raises eyebrows and pricks up ears. But that's only true in an office where you attract attention by leaving your row of cubes. When your co-workers are curled up in easy chairs and videoconferencing from quiet corners, you'll be able to inconspicuously pick a place to get things done.

# SIT BACK, RELAX

The chair of the future will form-fit your back, adjust itself, and possibly disappear altogether

**YOUR MOTHER WAS WRONG:** Sitting up straight is bad for you. Scottish radiologists confirmed in a study last year that a 130-degree angle of recline between torso and thighs reduces pressure on the discs in the lower back. This (and its sleek design) is why the ubiquitous Aeron chair was so ahead of its time in 1994. It deeply reclined by pivoting at the hips.

But designers find that the features of chairs like the Aeron are lost on most sitters. The array of levers and knobs—recline tension, lumbar support, seat-pan depth, forward tilt—are commonly ignored by users, who only think to change the chair's height.

This neglect has manufacturers such as Herman Miller and Humanscale looking toward the next frontier: a self-adjusting chair. "We're working on a chair that will listen to who's sitting on it and adjust itself to their weight," says Bill Dowell, director of research at Herman Miller, which makes the Aeron. Humanscale's Freedom chair includes a counterbalance system that adjusts itself like scales to the sitter's weight as he or she reclines,

eliminating the need for recline controls.

Or perhaps the chair of the future isn't one at all. Chairs contribute in part to the high rate of back pain, which, according to the National Institutes of Health, affects eight out of 10 Americans. "Our notion of a machine for sitting may not make sense in a globalized world," says Herman Miller designer Cameron Campbell. Galen Crazz of the University of California at Berkeley points out in her book *The Chair* that the Indian practice of squatting and the Muslim practice of stretching five times a day to pray have great ergonomic benefits. Ten years from now, one worker may settle into a low recliner, another will kneel on a soft carpet, and they'll talk across a pile of office cushions.—PETER HALL

**YOUR THRONE** Modern chair design is headed toward a deeply reclining, self-adjusting seat that's dynamically responsive to body weight.



**MORNING SHOT** Your a.m. routine may involve downing a burst of liquid energy, boosting your performance for 22 hours at a stretch.



# YOU SNOOZE, YOU LOSE

Want to keep pace with the competition? You'll soon need more than coffee

**AS A SPECIES**, we've hit the bedtime barrier. You can eat at your desk, socialize in the break room, and answer text messages on a date, but sooner or later, you're going to have to sleep. "After 18, 19 hours awake, your brain function starts to fail," says Dallas, Texas, sleep-medicine specialist Andrew O. Jamieson. Coffee might keep you up, "but you're not going to be focused."

Coffee? You might as well be commuting by buggy. Old-school stimulants like caffeine, amphetamines and the drug Ritalin are about to be marginalized by eugeroics. This emerging breed of "wakefulness" pills promises to keep the workers of tomorrow not just awake, but alert, on-task and feeling fine through the night and well into the next day. Remember these names, because they're your future: Modafinil, approved by the Food and Drug Administration in 1998 for the treatment of narcolepsy and marketed in the U.S. as Provigil, is already giving a competitive edge to everyone from Air Force pilots on 40-hour missions to (less legally) college students cramming for exams. The drug's maker, Cephalon in Frazer, Pennsylvania, is awaiting FDA approval for armodafinil, which promises even longer periods of

wakefulness on a single dose, and Irvine, California-based Cortex is working on its own drug, code-named CX717 and developed with funding from the military. The drugs are targeted at sleep disorders like narcolepsy, but it's their dramatic potential influence on the workplace that has researchers and efficiency experts buzzing.

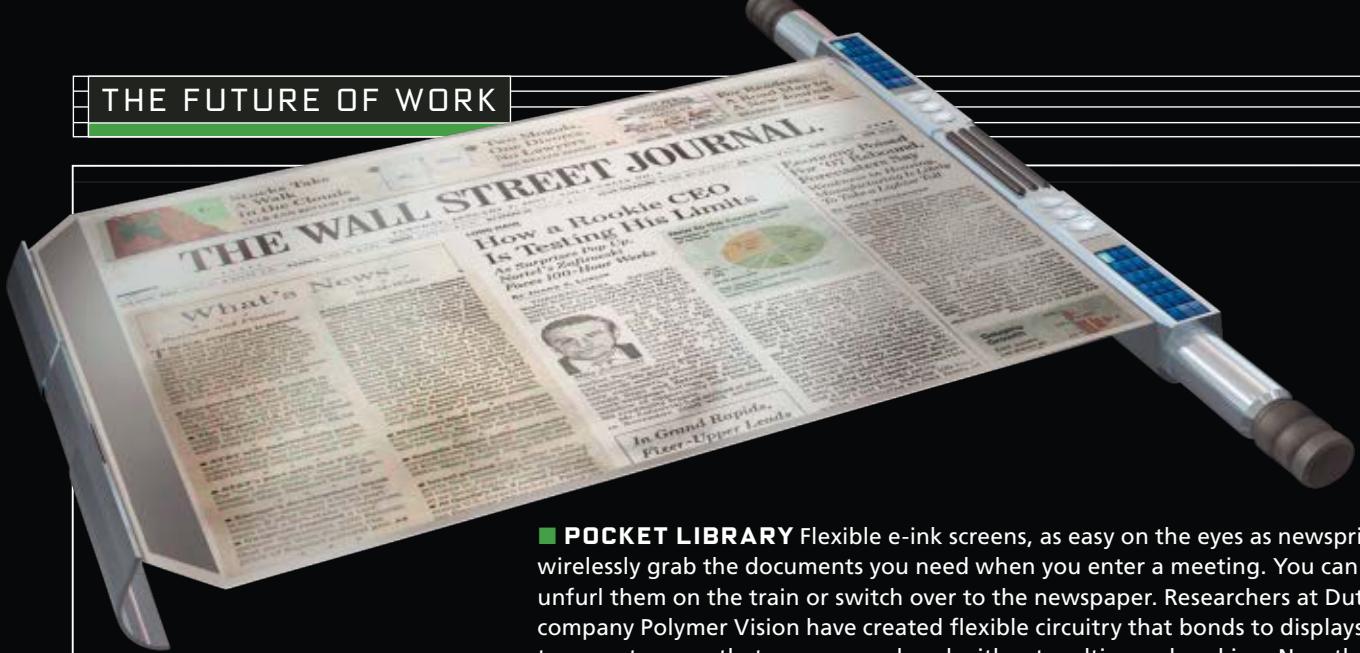
Scientists understand how the drugs work only broadly. Unlike traditional stimulants, eugeroics don't simply jazz up the whole body. Instead they tweak specific sleep-related mechanisms in the brain, so users don't feel jittery or wired, just alert. And in experiments with CX717, sleep-deprived rhesus monkeys on the drug often outperformed their own well-rested but undrugged best efforts on mental-performance tests. Modafinil, too, "is definitely a cognitive enhancer," says cognitive psychopharmacologist Barbara Sahakian of the University of Cambridge. In her studies of alert human volunteers, the drug improved planning, concentration and impulse-control skills, and even boosted some forms of memory.

Here's the rub: The drugs don't replace sleep, and decades of research show that sleep deprivation prompts immune dysfunction, depression and other disorders.

Sleep isn't something we should be looking to phase out of our lives.

Yet the economic pressure to stay out of bed is intense. Cutting out four hours of sleep a night would free up almost 1,500 extra hours a year. That's an additional nine months' worth of standard 40-hour workweeks—plenty of time to earn a promotion or start your own company on the side (or, worst case, slog away in obscurity). From Napoleon to Edison to Churchill, many of history's most notable figures got by on only a few hours of sleep a night. Give an entire workforce the energy of a Thomas Edison, and you've got a new Industrial Revolution.

For better or worse, when the trend takes hold, there will be no going back. Imagine sticking to double lattes while everyone else in the office—or at the start-up down the road—is juicing on the latest eugeroic, and you'll seem as naive and obsolete as the NFL linesman who swears by protein shakes alone. Any worker could benefit, says University of Virginia bioethicist Jonathan Moreno, author of the recent book *Mind Wars*. "But for consultants or contractors, people who aren't on a salary? The incentives are ridiculous."—THOMAS HAYDEN



■ **POCKET LIBRARY** Flexible e-ink screens, as easy on the eyes as newsprint, will wirelessly grab the documents you need when you enter a meeting. You can then unroll them on the train or switch over to the newspaper. Researchers at Dutch company Polymer Vision have created flexible circuitry that bonds to displays at low temperatures so that screens can bend without melting or breaking. Now they're working on circuits for high-resolution 8½-by-11-inch displays.

# OFFICE SUPPLIES 2017

In the future, technology will radically improve every aspect of even the most mundane desk accessories and office equipment

Papers, pens, staplers—you already have enough stuff on your desk. The people developing the next wave of office products aren't looking to add more to your drawers. Instead they want to make the stuff you already have

more useful. By taking all the small annoyances—lost papers, tangled cords, forgotten appointments—out of the workday, your new supplies will let you focus on that one big annoyance: your job.—LAUREN AARONSON

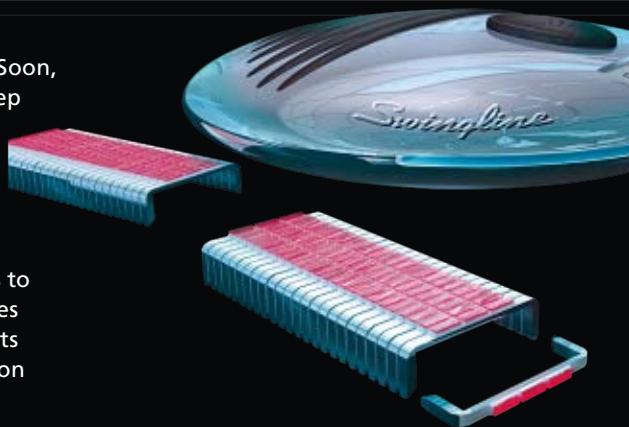


■ **ONE PEN FOR EVERYTHING** German pen company Staedtler created the first pen to write on almost anything. Next: ink that chemically adapts to that surface. Staedtler is closely watching academic research into smart inks, which change to optimize molecular bonds with a surface. Paper could trigger non-bleeding ink; whiteboards might produce a dry-wipeable substance.

■ **CORDLESS POWER** Snip the last cords on your desk. Wireless "power strips," developed by Pennsylvania-based Powercast, transmit energy from an outlet as radio waves. Add-on chips for low-power devices, such as cellphones, convert those waves into electricity when the items come within a few feet. The first products debut this year.



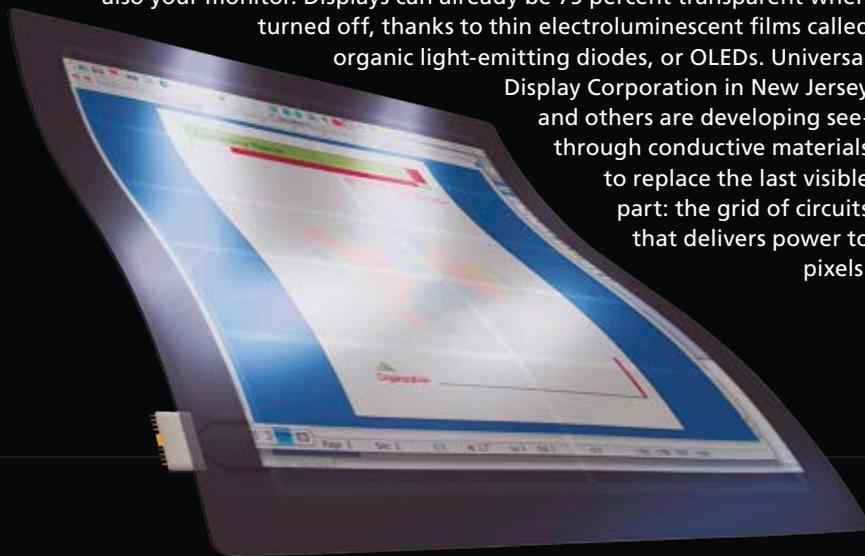
**■ NEVER LOSE ANOTHER MEMO** Soon, staples won't just keep papers together—they'll make sure you keep them, period. As RFID tags shrink in price and size, Swingline wants to embed them in staples so that lost documents can radio their location to a tracking device.



**■ FRIENDLY LOCKS** No more fumbling with passwords, ID cards or keys. In roughly five years, your desk will recognize you by looking at your face. Hidden cameras snap photos as you walk in, compare them to a database of users,

and unlock laptops, doors and personal data. To make sure new facial hair or dim lighting doesn't throw the system off, University of Tennessee researchers and others are investigating 3-D images that focus on difficult-to-change bone structure.

**■ TRANSPARENT MONITORS** Go ahead, stare out the window—it's also your monitor. Displays can already be 75 percent transparent when turned off, thanks to thin electroluminescent films called organic light-emitting diodes, or OLEDs. Universal Display Corporation in New Jersey and others are developing see-through conductive materials to replace the last visible part: the grid of circuits that delivers power to pixels.



**■ SUPER-HELPFUL PHONE** In a project at the Palo Alto Research Center in California, phones use nearby office cameras to detect when you're in a face-to-face or cellphone conversation. Natural-language software then picks out words like "meeting" and automatically fills in your calendar.



## SALES REPORT

### European Sectors - 1st Qtr 2007



### NEWS CRAWL

BREAKING HEADLINES

...United Korea lifts import tariff...  
 Toyota reports growth in personal  
 flight sector...British scientists:  
 hygiene at all-time high... Hurrica

**OLD SPICE** (8 oz, orig, SKU 25438)  
 Growth Market: Italy, EU  
 Regional Units (ytd): 238,012

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 onal VP, sales, Milan

### TREE

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### WEATHER

HURRICANE UPD

Hurricane Eddie  
 expected to hit b  
 Tuesday morning

### TRAVEL

WEEKEND BREAK

### MEMO

ANNIVERSARY TOMORROW

### P & G STOCK TICKER

MARKET CLOSING FIGURES

PG 04/06/11  
 NYSE 70.06 ▼-0.21% ▼-0.33%



20/20 VISION In P&G's "virtual cockpit" concept, an employee can scan the operations of the company the way a pilot scans his instruments.

# BUSINESS AS UNUSUAL

In the bowels of Procter & Gamble, one of the country's biggest, grayest companies, a maverick group is developing the cutting-edge future of the workplace BY JULIE SLOANE

**IF YOU WERE ASKED** to name five companies shaping the future of workplace technology, Procter & Gamble would almost certainly not make your list. From its products to its people, the 170-year-old grand dame of consumer goods is a standard-bearer of the big, corporate, nine-to-five workplace. It produces such supermarket staples as Clairol, Folgers and Old Spice—the sort of things given away as consolation prizes on *The Price Is Right*. And P&G's Cincinnati-based staff embodies a clean, conservative, Midwestern sensibility (they're famously loyal; most of the company's top executives have spent enough years with P&G to merit a gold watch).

While thousands of researchers plot the Pampers and Pringles of tomorrow, however, a little-known band of futurist thinkers is cooking up something else at P&G: cockpit-like displays of real-time business data, digital notebooks, virtual reality. Not the traditional fare of big, venerable companies, with big, antiquated computer systems. And because the company is such a marketplace leader—the world's number-one maker of household products has 22 brands worth at least a billion dollars—anything P&G implements inside its walls today determines what other old-school companies will consider standard business practice in a few years. So when a company this influential and traditional begins to tinker with the future, you know the future's coming.

## THE IT DEPARTMENT REMADE

Any information-technology (IT) worker carries a double burden. No one is better acquainted with a company's kludgy data management and outdated systems,

yet rather than consult on-the-ground IT workers about the big picture, upper management typically ignores them. P&G has done it differently. In 2003, as part of a 10-year, \$3-billion outsourcing deal, the firm turned over half its IT functions—the mundane maintenance stuff—to Hewlett-Packard. With a few signatures and handshakes, 2,000 P&G techies became HP employees.

Over the next two years, Procter & Gamble became a very attractive company for IT people. It reshaped its remaining 4,000-person IT force, recast it as Information and Decision Solutions (IDS), and put Filippo Passerini in charge. Passerini is an IT guy's dream boss. A native of Rome, he has worked at P&G for his entire 25-year career, mostly managing IT operations in Europe, the Middle East and Latin America. He's competent in a way that IT people respect. He has the political gift of remembering names and winning over strangers with a warm handshake and a few words. And for the people who work for him (especially when your job title makes people think of *Star Trek* T-shirts), it's nice to have a sophisticated, smooth-talking, trilingual Italian as your protector. Over the past two years, Passerini has eaten group lunches with more than 15,000 P&G employees, asking the kinds of big-picture questions that almost never get asked: What drives you craziest about the process around here? If you could have a fantasy tool that made your job easier, what would it be?

P&G wanted Passerini, an organization freak who breaks his day into five-minute increments, to make the company tighter, leaner and faster. For a company making toothpaste, air freshener and laundry detergent, having that new Swiffer gizmo

out even a few days ahead of a competitor's version can mean millions of dollars in profit. To that end, Passerini tasked roughly 400 employees—20 percent of IDS—to develop the IT of P&G's future. Now IDS employees working in one of several teams spend their days weighing far-out solutions to high-level problems. How can prototyping happen more quickly? What's the best way to ensure that no one's doing the same job twice? Instead of puzzling over a broken server, IDS techies spend their days puzzling over how workers can be better served, and then they wire the solutions together.

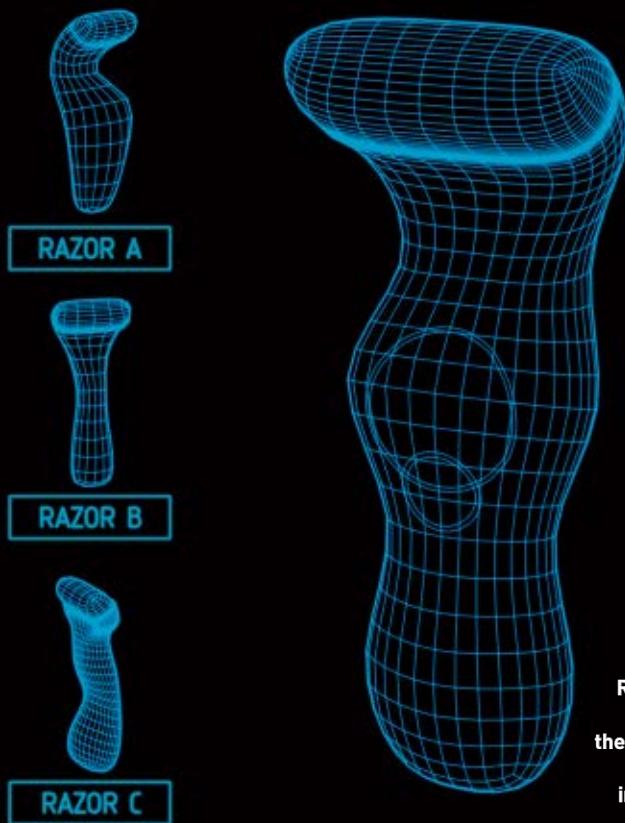
In committing money and people to developing future tech, says Lewis Cardin, a senior analyst of IT leadership at Forrester Research, P&G is unique. "Most CIOs are only able to manage things the way they are today, in 2007," he says. Passerini's band of futurists are preparing for problems the other big corporations aren't even thinking about yet. And if other companies aren't watching what Passerini and his people are up to, Cardin says, "they should be."

It may sound like classic start-up enthusiasm, but this is no 30-employee dot-com. When you consider that anything P&G does must withstand intense legal and corporate scrutiny and work on a tremendous scale—140,000 employees in 80 countries—what P&G is trying to pull off suddenly looks a lot gutsier.

## QUARTERLY REPORTS, HOURLY

At a company as large as P&G, information is like a wave on the shore: It crashes onto the rocks and flows into tide pools and crevasses throughout the company. Some is retained, some is lost forever. If a P&G marketer in Toronto wants to point out a

## PLEASE TOUCH THE MOST APPEALING SHAPE



**PERSONAL TOUCH**  
Rather than making prototypes, trying them on focus groups, and then remaking them, P&G tests virtual products.

problem to his boss concerning, say, how many tubes of Crest were sold in Canada last week, he must gather data from e-mails, letters, phone calls and reports from inside and outside the company. Only after days of digging can he compile and analyze the resulting data and issue a report to his superior, who adds it to the pile on his desk. Weekly reports, quarterly reports, annual reports—they're just an accepted part of doing business today.

IDS is making that mess of papers and conversations tidy, centralized and digital. What if that same marketer could glance at a yellow circle in the lower-left-hand corner of his computer screen at any time and know by its size how well Crest is selling? While he's at it, why not give him the ability to see, for instance, in what hours of the day customers bought Crest in Argentina?

P&G is laying the groundwork for such a system with what it calls "decision cockpits." The problem with reports, P&G brand managers told Passerini at lunch, is both the lag time in receiving the data—a

two-week delay on even simple data requests was not uncommon—and the fact that there aren't enough cups of coffee in the world to read and absorb what comes back.

In the same way a pilot quickly scans his instruments, P&G wants to present real-time data in visual form. In the current iteration, a highly sophisticated onscreen display offers information such as bar charts for the market share of a product by country, city or even store, or container information from a port warehouse shipping products abroad. Employees can quickly and easily refine what they're shown to ensure that the display emphasizes the most useful information. The next step is to link the company's various distribution channels through radio-frequency identification (RFID) tags affixed to crates and products, as companies like Wal-Mart have done so successfully to keep track of their inventory. It's that interconnectedness that will truly make total corporate awareness feasible.

Other companies (P&G points to BP, Exxon and IBM) are also experimenting with cockpits, but P&G believes that it is planning to use them on an unprecedented scale. An early version has been rolled out to 3,000 employees, including CEO Alan Lafley. In the next two years, P&G hopes to add 30,000 more, and IDS designers are dreaming of a room-size, virtual-reality version in which employees can close the door and study their responsibilities in vivid detail.

### VIRTUAL PRODUCT TESTING

Nothing leaves Procter & Gamble without high marks from a focus group. At any given time in one of several labs around the world, someone is sniffing a new deodorant, or thoughtfully chewing a stick of a new gum, while researchers take notes on clipboards.

For each focus group, P&G creates several physical samples of its product, which are then refined and tested again. At any consumer-products company, this sort of back-and-forth is part of the process. But P&G is taking it a step further. IDS created a virtual baby that sits, crawls, and toddles in 3-D while wearing—you got it—a virtual diaper. "Based on what we know of mechanics," says IDS's Keith Caserta, an associate director and head of health care R&D, "is the diaper going to bunch up and be uncomfortable? Is it going to leak?" If so, an adjustment to the virtual diaper can happen that same day. "You can test a diaper in hours instead of weeks," Passerini enthuses. In addition, Caserta points out, virtual testing allows scientists around the globe to collaborate on a product-development project, without the delays and inconvenience of travel. Only at the end of the process does the company need to spend the time and money on creating a tangible version.

Today P&G has four "caves" for testing virtual prototypes and working in 3-D: in Japan, England, Switzerland and Cincinnati. Built inside a black room, each cave is a 10-foot-square cube made of white panels, open on the top and one side. Using high-end stereoscopic projectors, images are projected onto the three walls and the floor. By donning special plastic glasses, visitors to the cube experience the projected

world—a baby-changing room, a suburban kitchen, a Wal-Mart aisle—as if they are physically inside it, and scroll through the environment with a hand controller.

Any beachfront arcade has a virtual-reality game these days. But this VR world has to be real in much more than the virtual sense of the word, responding to the laws of supply, demand, proportion and other logistical limitations imposed on it from all over the company. P&G engineers also use the caves to design the layout of manufacturing plants and assembly lines. In the future, Caserta says, P&G scientists will even plot their equations in 3-D and walk around inside the data to ponder it in new ways.

### SYNCHRONIZED NOTE-TAKING

If you've ever wondered, when your boss handed you an unpleasant project, why someone else couldn't have done this, the answer is often that someone already did. Duplicate effort is all too common at big

companies, and P&G estimates that 15 percent of all its research is duplicated work.

The waste is extraordinary. Of P&G's 8,000 researchers, 5,500 regularly record experimental data in lab notebooks, each spending an average of 10 hours per week writing. For legal reasons, the company must retain all of these notebooks, so failed experiments wind up buried under thousands of pounds of paper. Rather than dig through it all to see whether the work's been done before, it's often easier for P&G researchers to just repeat the experiment.

The company is calling its first step toward tracking these experiments the "electronic notebook" and says it's already saving each scientist two hours a week in scrawl time. In its current, humble iteration, the "notebooks" are a Web site, used by a test group of 200 researchers to record their work. Once entries are completed, the data is frozen. Any changes must be tracked, key to legally proving who invented what when (intellectual property

is serious business at P&G). The company plans to expand to 1,000 users by September. In partnership with Plano, Texas-based UGS, the software will be commercially available to anyone in March. Combined with a pen that transmits jotted notes to a computer as digital text, the system could be as convenient as writing by hand, while at the same time archiving every word.

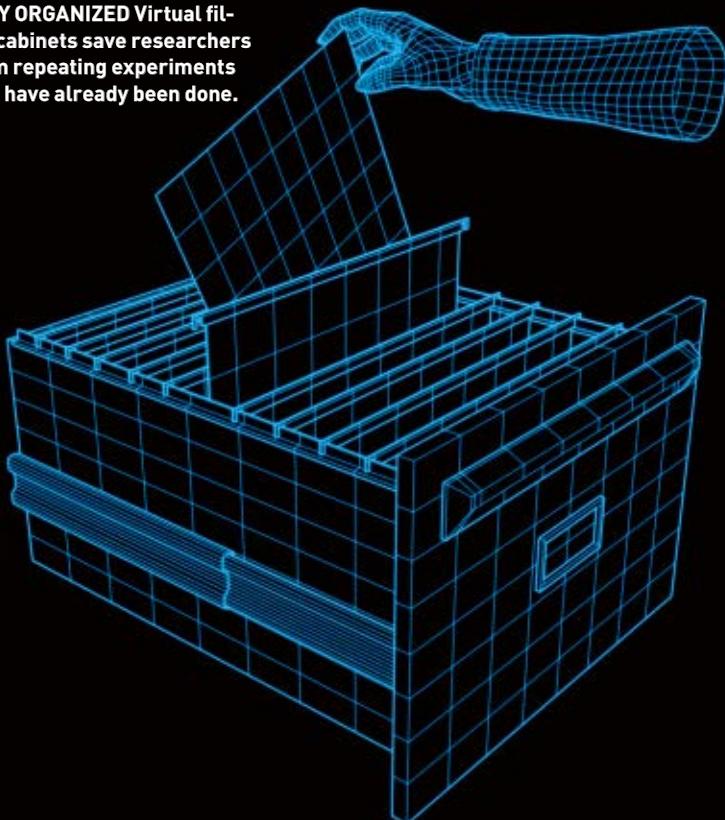
The site is an early step toward Passerini's vision of a transparent, interconnected organization. "If you think about it," Passerini says, "what holds you to a physical office is your filing cabinet. Why can't the digital world match the physical world?" Using technology similar to that in the prototyping caves, IDS is researching the notion of a virtual filing cabinet, where, by touch or voice command, an employee might flip through sensitive documents, which look as they do in a filing cabinet, and graphically pull out the required one. Related documents would appear to the side of the one you're "holding," and, most important, a constant search of the system for related keywords, images and project names would bring up any similar work other employees had already completed.

Working for a corporate behemoth, it's easy to get lost in the day-to-day of the present. But by injecting new, more dynamic visual interfaces at P&G, Passerini believes that even the most complicated future technologies will become intuitive and helpful parts of the workaday world. "For my grandfather, a refrigerator was breakthrough technology," he says. "But we don't even consider that to be a form of technology anymore. It's just part of our lives." If P&G succeeds in popularizing its vision of the visual, searchable workplace, Passerini's own grandchildren will laugh at the thought of making prototypes by hand or waiting weeks to get back data analysis. Which isn't to say that Passerini's excitement will be passed on to the next generation. To them, spending the workday fitting giant 3-D diapers onto a virtual baby may be just as mundane as punching the clock at a company that makes toothpaste and laundry detergent.

*Julie Sloane is an editor at large at Fortune Small Business magazine.*

## IDS IS MAKING P&G'S MESS OF PAPERS AND CONVERSATIONS TIDY, CENTRALIZED AND DIGITAL.

**STAY ORGANIZED** Virtual filing cabinets save researchers from repeating experiments that have already been done.



# HELP WANTED

A peek at the classifieds circa 2017 BY DOUG CANTOR



## JOB OF THE MONTH MOON-LAUNCH MAINTENANCE ENGINEER

The launch engineer is responsible for the upkeep and management of equipment for a high-traffic, commercial-passenger launchpad on Earth's moon.

**QUALIFICATIONS:** The ideal candidate has a c-130a federal space-travel certification, with a specialty in high-induction cooling systems and the handling of highly volatile fuels. The ability to work quickly and competently in a wide variety of gravities is a must. This is a union position.

**COMPENSATION:** Base salary of \$105/hour for a six-month assignment. Note that 24-hour sunlight at the lunar-pole location means all shifts are day shifts.



### ROBOT PERSONALITY ENGINEER

BotWorks®, a wholly-owned subsidiary of

the Dynamic Corporation, is looking for engineers to design pleasant, professional dispositions for the next generation of cleaning, security and personal-service robots.

**QUALIFICATIONS:** Must be willing to work as part of a team of engineers and designers to develop a variety of effective and lifelike personalities, voices and other characteristics. A good sense of humor and an advanced degree in behavioral science are preferred.

**COMPENSATION:** The intelligence is artificial, but the money is real! \$150,000 to \$200,000 starting salary depending on experience, plus a generous benefits package, your own robot helper and the opportunity to matriculate on to military applications.



### MMORPG CONSULTANT

Doing business in the real world is so 2013.

Our company needs a consultant to completely overhaul our massively multiplayer online role-playing operations. Help us create new product designs, improve our A2A (avatar-to-avatar) customer service, and develop sharp marketing plans exclusively for the simulated-society space.

**QUALIFICATIONS:** An MBA with a concentration in virtual consulting is required. Experience redesigning next-gen corporate-training programs and university courses is a plus. Physical location flexible.

**COMPENSATION:** Determined on a project-by-project basis, but motivated individuals can earn \$200,000+. Additional MMORPG-only compensation and barter negotiable.



### PRE-BIRTH DESIGN COUNSELOR

Northern California

IVF clinic needs counselors to work with prospective parents before they conceive to make informed decisions about the alteration of characteristics such as hair color, height, intelligence and susceptibility to disease in the embryo.

**QUALIFICATIONS:** Joint degrees in social psychology and germline genetic engineering. Familiarity with current international genetic-engineering laws is a prerequisite, and education in bioethics is a plus.

**COMPENSATION:** Salaries begin at \$125,000/year DOE, with a bonus for parent satisfaction after the first nine months. Salary to be paid monthly until legal issues are settled in appeals process.



### SMART-CAR MECHANIC

Honda Motors is

seeking factory mechanics to install and maintain Galileo global-positioning equipment, collision-avoidance radar and traffic-monitoring communications systems in its newest line of cars, designed for use with automated highway networks.

**QUALIFICATIONS:** Familiarity with latest communications technology, especially for current driverless cars, and experience working on non-fuel engines.

**COMPENSATION:** \$75/hour, plus benefits. This is a union position. Pay increases for candidates with associate/bachelor's degree in information technology.



### THOUGHT-POWERED ELECTRONICS ENGINEER

The engineer designs sensors that translate neurological impulses into commands for a variety of devices. Positions are available in our medical-products division, designing brain-machine interface actuators for the disabled, as well

as in the military division developing thought-controlled aircraft and weaponry.

**QUALIFICATIONS:** Advanced degree in neuroscience and extensive knowledge of thought-sensor technology.

**COMPENSATION:** \$350,000/year, medical, dental, vision, and discounts on medical and household equipment.



### SOLAR-POWER NANOENGINEER

Wanted: a nanoengineer to improve the

efficiency of thin-film solar cells and increase the stability of their wire leads at the molecular level, while still maintaining scalability.

**QUALIFICATIONS:** Advanced degree in electrical, chemical, biological or molecular engineering. Special consideration given to applicants with prior experience at a nanotech start-up.

**COMPENSATION:** \$125,000 to \$140,000 per year starting salary, along with a chance for equity in a company at the leading edge of a rapidly growing field.



### VIRTUAL HEALTH-CARE-MAINTENANCE WORKERS

We have numerous positions open for hardworking team members to conduct online physical examinations, do remote blood-pressure tests and other distance vital-sign analysis, and access specialized implanted diagnostic devices to identify patient conditions such as diabetes or stroke.

**QUALIFICATIONS:** Must be a licensed practical nurse or physician's assistant capable of administering complex medical services as new technology becomes available. Excellent bedside manner is essential.

**COMPENSATION:** \$100,000 per year starting salary, depending on placement in either a neighborhood clinic, city hospital or primary-care drugstore facility.

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# THE PROPHET

## THREE KEY FACTS

- 1** America now generates **245 million tons of municipal solid waste** every year—twice as much as 35 years ago.
- 2** Startech reduces trash into its **constituent components** by using plasma energy to tear apart molecular bonds.
- 3** The process **creates more electricity than it consumes**, allowing companies to profit from selling excess power.

# OF GARBAGE

Joseph Longo has invented a machine that turns our most vile trash into clean energy—and promises to make a relic of the landfill

BY MICHAEL BEHAR  
PHOTOGRAPHS BY  
JOHN B. CARNETT



MR. CLEAN Joseph Longo, here with his demonstration Plasma Converter in Bristol, Connecticut, has built a career around uniting trash and tech.

**T SOUNDS AS IF** someone just dropped a tricycle into a meat grinder. I'm sitting inside a narrow conference room at a research facility in Bristol, Connecticut, chatting with Joseph Longo, the founder and CEO of Startech Environmental Corporation. As we munch on takeout Subway sandwiches, a plate-glass window is the only thing separating us from the adjacent lab, which contains a glowing caldera of "plasma" three times as hot as the surface of the sun. Every few minutes there's a horrific clanking noise—grinding followed by a thunderous *voomp*, like the sound a gas barbecue makes when it first ignites.

"Is it supposed to do that?" I ask Longo nervously. "Yup," he says. "That's normal."

Despite his 74 years, Longo bears an unnerving resemblance to the longtime cover boy of *Mad* magazine, Alfred E. Neuman, who shrugs off nuclear Armageddon with the glib catchphrase

**"YOU CAN'T RELY ON PEOPLE TO TELL YOU WHAT THEY PUT IN THE TRASH. SOMETIMES THEY DON'T KNOW, SOMETIMES THEY LIE, AND SOMETIMES THEY'VE THROWN IN LIVE SHOTGUN SHELLS."**

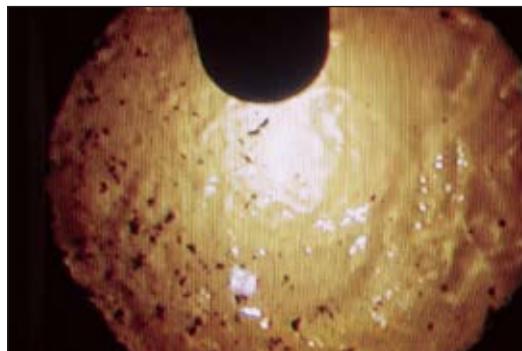
"What, me worry?" Both share red hair, a smattering of freckles and a toothy grin. When such a man tells me I'm perfectly safe from a 30,000° F arc of man-made lightning heating a vat of plasma that his employees are "controlling" in the next room—well, I'm not completely reassured.

To put me at ease, Longo calls in David Lynch, who manages the demonstration facility. "There's no flame or fire inside. It's just electricity," Lynch assures me of the multimillion-dollar system that took Longo almost two decades to design and build. Then the two usher me into the lab, where the gleaming 15-foot-tall machine they've named the Plasma Converter stands in the center of the room.

The entire thing takes up about as much space as a two-car garage, surprisingly compact for a machine that can consume nearly any type of waste—from dirty diapers to chemical weapons—by annihilating toxic materials in a process as old as the universe itself. Called plasma gasification, it works a little like the big bang, only backward (you get nothing from something). Inside a sealed vessel made of stainless steel and filled with a stable gas—either pure nitrogen or, as in this case, ordinary air—a 650-volt current passing between two electrodes rips electrons from the air, converting the gas into plasma. Current flows continuously through this newly formed plasma, creating a field of extremely intense energy very much like lightning. The radiant energy of the plasma arc is so powerful, it disintegrates trash into its constituent elements by tearing apart molecular bonds. The system is capable of breaking down pretty much anything except

nuclear waste, the isotopes of which are indestructible. The only by-products are an obsidian-like glass used as a raw material for numerous applications, including bathroom tiles and high-strength asphalt, and a synthesis gas, or "syngas"—a mixture of primarily hydrogen and carbon monoxide that can be converted into a variety of marketable fuels, including ethanol, natural gas and hydrogen.

Perhaps the most amazing part of the process is that it's self-sustaining. Just like your toaster, Startech's Plasma Converter draws its power from the electrical grid to get started. The initial voltage is about equal to the zap from a police stun gun. But once the cycle is under way, the 2,200° F syngas is fed



into a cooling system, generating steam that drives turbines to produce electricity. About two thirds of the power is siphoned off to run the converter; the rest can be used on-site for heating or electricity, or sold back to the utility grid. "Even a blackout would not stop the operation of the facility," Longo says.

It all sounds far too good to be true. But the technology works. Over the past decade, half a dozen companies have been developing plasma technology to turn garbage into energy. "The best renewable energy is the one we complain about the most: municipal solid waste," says Louis Circeo, the director of plasma research at the Georgia Institute of Technology. "It will prove cheaper to



**BURN, BABY, BURN** Longo's Plasma Converter [above] is built in part from off-the-shelf components. The plasma torch contained in the vessel at left above is borrowed from the metal-fabrication world. A video screen [facing page] allows operators to see what's going on inside the burn chamber as the plasma arc rips electrons from the surrounding air. Longo [right] designed his machine to convert the syngas that results from the gasification process into hydrogen.



take garbage to a plasma plant than it is to dump it on a landfill." A Startech machine that costs roughly \$250 million could handle 2,000 tons of waste daily, approximately what a city of a million people amasses in that time span. Large municipalities typically haul their trash to landfills, where the operator charges a "tipping fee" to dump the waste. The national average is \$35 a ton, although the cost can be more than twice that in the Northeast (where land is scarce, tipping fees are higher). And the tipping fee a city pays doesn't include the price of trucking the garbage often hundreds of miles to a landfill or the cost of capturing leaky methane—a greenhouse gas—from the decomposing waste. In a

city with an average tipping fee, a \$250-million converter could pay for itself in about 10 years, and that's without factoring in the money made from selling the excess electricity and syngas. After that break-even point, it's pure profit.

Someday very soon, cities might actually make money from garbage.

### TALKING TRASH

It was a rainy morning when I pulled up to Startech R&D to see Longo waiting for me in the parking lot. Wearing a bright yellow oxford shirt, a striped tie and blue pinstriped pants, he dashed across the blacktop to greet me as I stepped from my rental car. A street-smart Brooklyn native, Longo was an only child raised

by parents who worked long hours at a local factory that made baseballs and footballs. He volunteered to fight in Korea as a paratrooper after a friend was killed in action. He's fond of antiquated slang like "attaboy" and "shills" (as in "those shills stole my patents") and is old-school enough to have only recently abandoned the protractors, pencils and drafting tables that he used to design his original Plasma Converter in favor of computers.

Today, Longo is meeting with investors from U.S. Energy, a trio of veteran waste-disposal executives who recently formed a partnership to build the first plasma-gasification plant on Long Island, New York. They own a transfer station (where garbage goes for sorting en route

to landfills) and are in the process of buying six Startech converters to handle 3,000 tons of construction debris a day trucked from sites around the state. “It’s mostly old tile, wood, nails, glass, metal and wire all mixed together,” one of the project’s partners, Troy Caruso, tells me. For the demonstration, Longo prepares a sampling of typical garbage—bottles of leftover prescription drugs, bits of fiberglass insulation, a half-empty can of Slim-Fast. A conveyer belt feeds the trash into an auger, which shreds and crushes it into pea-size morsels (that explains the deafening grinding sound) before stuffing it into the plasma-reactor chamber. The room is warm and humid, and a dull hum emanates from the machinery.

Caruso and his partners, Paul Marazzo and Michael Nuzzi, are silent at first. They’ve seen the demo before. But as more trash vanishes into the converter, they become increasingly animated, spouting off facts and figures about how the machine will revolutionize their business. “This technology eliminates the

landfill, which is 80 percent of our costs,” Nuzzi says. “And we can use it to generate fuel at the back end,” adds Marazzo, who then asks Lynch if the converter can handle chunks of concrete (answer: yes). “The bottom line is that nobody wants a landfill in their backyard,” Nuzzi tells me. New York City is already paying an astronomical \$90 a ton to get rid of its trash. According to Startech, a few 2,000-ton-per-day plasma-gasification plants could do it for \$36. Sell the syngas and surplus electricity, and you’d actually net \$15 a ton. “Gasification is not just environmentally friendly,” Nuzzi says. “It’s a good business decision.”

The converter we’re watching vaporize Slim-Fast is a mini version of Startech’s technology, capable of consuming five tons a day of solid waste, or about what 2,200 Americans toss in the trash every 24 hours. Fueled with garbage from the local dump, the converter is fired up whenever Longo pitches visiting clients.

Longo has been talking with the National Science Foundation about

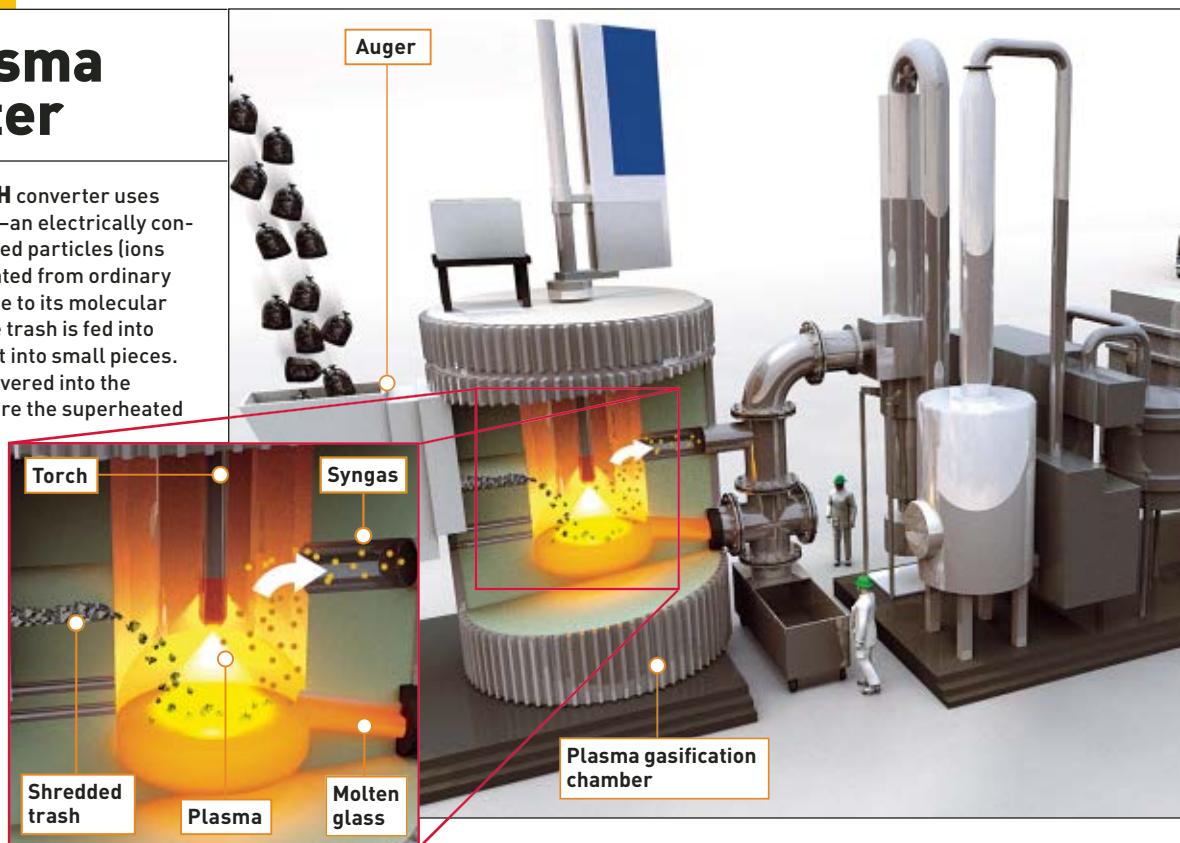
installing a system at McMurdo Station in Antarctica. The Vietnamese government is considering buying one to get rid of stockpiles of Agent Orange that the U.S. military left behind after the war. Investors from China, Poland, Japan, Romania, Italy, Russia, Brazil, Venezuela, the U.K., Mexico and Canada have all entered contract negotiations with Startech after making the pilgrimage to Bristol to see Longo’s dog-and-pony show.

Startech isn’t the only company using plasma to turn waste into a source of clean energy. A handful of start-ups—Geoplasma, Recovered Energy, PyroGenesis, EnviroArc and Plasco Energy, among others—have entered the market in the past decade. But Longo, who has worked in the garbage business for four decades, is perhaps the industry’s most passionate founding father. “What’s so devilishly wonderful about plasma gasification is that it’s completely circular,” he says. “It takes everything back to its fundamental components in a way that’s beauti-

HOW IT WORKS

# The Plasma Converter

**STARTECH’S TRASH** converter uses superheated plasma—an electrically conductive mass of charged particles (ions and electrons) generated from ordinary air—to reduce garbage to its molecular components. First the trash is fed into an auger that shreds it into small pieces. Then the mulch is delivered into the plasma chamber, where the superheated plasma converts it into two by-products. One is a syngas composed mostly of hydrogen and carbon monoxide, which is fed into the adjacent Starcell system to be converted into fuel. The other is molten glass that can be sold for use in household tiles or road asphalt.





WASTE, NOT Startech's sample fuel

**I'VE WATCHED LYNCH OPERATE THE CONVERTER FOR NEARLY AN HOUR, AND I'M STILL STUNNED TO SEE NO SMOKE, NO FLAMES, NO ASH, NO POLLUTION OF ANY KIND.**

ful." Although all plasma gasification systems recapture syngas to turn into fuel, Startech's "Starcell" system seems to be ahead of the pack in its ability to economically convert the substance into eco-friendly and competitively priced fuels. "A lot of other gasification technologies require multiple steps. This is a one-step process," says Patrick Davis of the U.S. Department of Energy's office of hydrogen production and delivery, which has awarded Longo's company almost \$1 million in research grants. "You put the waste in the reactor and you get out the syngas. That's it."

### THE GARBAGE MAN

After his tour of duty in Korea, Longo put himself through night school at the Brooklyn Polytechnic Institute. In 1959, engineering degree in hand, he got a job at American Machine & Foundry (AMF)—the same company that today runs the world's largest chain of bowling alleys—designing hardened silos for nuclear intercontinental ballistic missiles, such as Titan and Minuteman. "There was never a time I can remember when I didn't want to be an engineer," he says.

For years, Longo tried to convince his bosses at AMF to go into the garbage business (as manager of new product development, he was charged with investigating growth areas). "I knew a lot about the industry, how backward it was," he says. The costs to collect and transport waste were climbing. He was sure there had to be a better way.

In 1967 Longo quit his job at AMF to start his own business, called International Dynetics. The name might not be familiar, but its product should: Longo designed and built the world's first industrial-size trash compactors. "If you live in a high-rise or apartment building and dump your trash down a chute," he says, "it's probably going into one of our compactors."

When Longo started his company, it was still easier and cheaper to just haul the loose trash to the dump. But gas prices climbed, inflation increased, and soon, business boomed. In a few years, there were thousands of International Dynetics compactors operating around the world. The machines could crush the equivalent of five 30-gallon cans crammed with trash into a cube that was about the size of a small television. "Our purpose was

to condense it so it would be easier and cost less to bring to a landfill," he says.

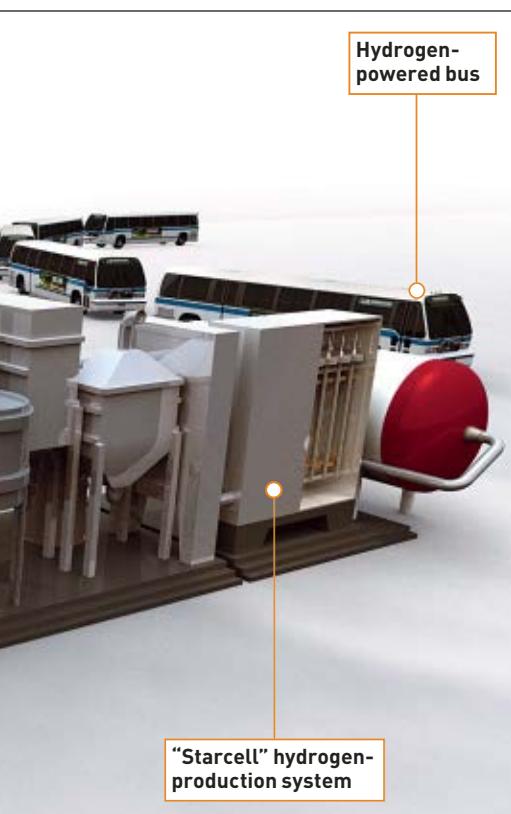
Then, in 1972, Longo read a paper in a science journal about fusion reactors. "The authors speculated that plasma might be used to destroy waste to the elemental level someday in the future," he recalls. "That was like a spear in the heart, because we had just got our patents out for our trash compactors, and these guys were already saying there's a prettier girl coming to town," he says. "It would make obsolete everything we were doing. I resisted looking at the technology for 10 years. But by 1984, it became obvious that plasma could do some serious work."

By then, the principal component of today's plasma gasification systems, the plasma torch, had become widespread in the metal-fabrication industry, where it is used as a cutting knife for slicing through slabs of steel. Most engineers at the time were focused on ways to improve plasma torches for manipulating metals. But Longo had trash on the brain—whole landfills of trash. He was intent on developing a system that used plasma to convert waste into energy on a large scale. So he jumped ship again. In 1988 Longo sold International Dynetics and founded Startech.

### PLASMA TO THE PEOPLE

"People kept asking me, 'If this is so good, Longo, then why isn't everyone already using one?'" he says, referring to himself in the third person, a device he relies on frequently to emphasize his point. "We had the technical capability, but we didn't have a product yet. Just because we could do the trick didn't mean it was worth doing." Trucking garbage

(CONTINUED ON PAGE 86)



Hydrogen-powered bus

"Starcell" hydrogen-production system

## PREDICTING ERUPTIONS

On average, 60 of the planet's roughly 1,500 potentially active volcanoes erupt annually—and three of those eruptions prove to be fatal. Here's the latest on how scientists are using technology to better forecast when a volcano is likely to blow

BY KEVIN KRAJICK

ILLUSTRATION BY GRAHAM MURDOCH

### WHO'S WATCHING

The U.S. Geological Survey deploys seismologists and other specialists to watch 169 active U.S.-controlled trouble areas and to help other countries, such as Indonesia, monitor their own problem mountains. Other countries with substantial efforts include Mexico, Italy and Japan. But even the USGS funds full-scale monitoring on only three of 18 locations considered "very high threat": Hawaii's Kilauea, Washington's Mt. St. Helens and California's Long Valley Caldera. It's dangerous work—on average worldwide, one volcanologist dies on the job every year.



## FAQs KNOW YOUR ENEMY

### WHY DO VOLCANOES ERUPT?

Most volcanoes sit on continental edges, where subducting tectonic plates melt to create magma. Other "hot spots," like Yellowstone, sit atop places where streams of mantle material rise close to the surface. No one knows what the immediate triggers are. They could include

new influxes of magma or gas from below, or changes in surface pressure caused by snow, sea levels or lunar tides.

### HOW DO THEY KILL?

Lava almost never kills anyone; it's too slow. Most victims die in pyroclastic flows—explosions of hot gases and rocks that race down slopes at more than 180

miles an hour. Others are overtaken by lahars (fast flows of mud) or tsunamis.

### WHO'S AT RISK?

One in 10 people lives near Earth's 1,500-odd potentially active volcanoes, which every year produce two to four fatal eruptions. Check *volcanoes.usgs.gov* for ones near you.

### WHAT SIGNS SHOULD I LOOK FOR?

In addition to earthquakes, people living near volcanoes say that a sudden drying of wells is a bad sign—possibly valid, since magma-driven ground movements could shift water tables. Others say that animals will act strangely, but there's no science to back this up.



### HOW THEY WATCH FIND THE BULGE

As pent-up magma swirls near the surface, it can make the mountain bloat. Scientists compare satellite images taken weeks or years beforehand to search for bulges and other clues. They also use GPS-linked tiltmeters on the ground to pinpoint vertical or horizontal movements. **Warning time: months to years**

### STUDY THE SURFACE

Scientists simply look at the ground for new features. For example, fissures and steam vents form when water superheated by magma bursts from the earth. **Warning time: days to weeks**

### SMELL FOR A GAS LEAK

Dissipating gases such as carbon dioxide or sulfur dioxide reach the open air through fissures and pores. Scientists can collect gases directly from holes called fumaroles, but more often they use remote gas-identifying spectrometers. **Warning time: days to weeks**

### LISTEN FOR RUMBLINGS

As magma breaks up rocks six to 12 miles below the surface, it causes "swarms" of high-frequency earthquakes; gurgling magma causes lower-frequency tremors. As the magma rises, the shaking turns into "volcanic tremor"—a continuous low bass hum from the mountain. **Warning time: weeks to months**

### TIME TO GO

Many scientists have begun to use codes similar to the terror-alert system, giving an estimated percentage likelihood of a big eruption within a certain number of weeks, days or hours.

MOUNT PINATUBO, 1991



### THE WORLD'S HOTTEST SPOTS

Italy's **MT. VESUVIUS**, with one million people living nearby and a history of violence, tops almost everyone's danger list.

**MT. RAINIER**, looming over Seattle, hasn't erupted in over a century. This is not a comfort; big lulls between eruptions usually portend a bigger explosion.

Indonesia's **MT. MERAPI** has been spewing ash and lava since last spring.

Ongoing activity at **SOUFRIÈRE HILLS** has caused half of the Caribbean island of Montserrat to remain evacuated since 1996.

Sicily's **MT. ETNA**, bristling with more instruments than any other volcano, gives frequent fireworks displays.

## PREDICTION REPORT CARD

**AUGUST 24, A.D. 79** The Roman naturalist Pliny the Elder, who took earthquakes as warnings of impending eruption, observes the sudden reawakening of Mt. Vesuvius and perishes when it annihilates Pompeii.

**1766–1794** William Hamilton, the British ambassador to Naples, notes that before eruptions of Vesuvius, quakes intensify and snow melts from the mountainside. He accurately predicts at least one blowup

several days in advance, warning the king of Naples to flee his palace.

**MAY 8, 1902** Despite rumbling from Mt. Pelée on the island of Martinique, the mayor of St. Pierre decides not to evacuate. Nearly 28,000 die. Among the few survivors is a prisoner in a dungeon.

**MAY 18, 1980** Mt. St. Helens stirs from a century-long sleep with swarms of earth-

quakes and a visible bulge on its north flank. The initial blast sears more than 220 square miles and kills 57 people, including USGS geologist David Johnston.

**MARCH 15–JUNE 15, 1991** Scientists notice quakes and rising gas emissions around the Phillipines's Mt. Pinatubo. Pinatubo produces the second-greatest explosion of the 20th century. Some 200,000 survive because they heeded evacuation orders.



# ALL SONIC, NO BOOM

Long hampered because the planes were too loud to fly over land, supersonic air travel is now on its way back—without the big bang

BY ERIC HAGERMAN ILLUSTRATION BY NICK KALOTERAKIS

**IF YOU'RE EVER LUCKY ENOUGH** to fly a Quiet Supersonic Transport between New York and Los Angeles, you'll have just enough time to get through a movie—a short one. Instead of the usual six hours, it will be a 1,100mph, two-hour hop. The QSST, as the proposed luxury private jet is known, could be the first civilian supersonic plane approved for overland routes, thanks to aerodynamics designed to muzzle its sonic boom. Lockheed Martin's Skunk Works has been developing the project for six years under a \$25-million contract from Supersonic Aerospace International (SAI), founded by Michael Paulson, son of Gulfstream founder Allen Paulson. The 12-passenger QSST would fly at between



## QUIET SUPERSONIC TRANSPORT (QSST)

**PURPOSE:** High-speed private flights over land and sea

**MANUFACTURER:** Lockheed Martin and Supersonic Aerospace International

**RANGE:** 4,600 miles

**SPEED:** Mach 1.6 to 1.8 (approx. 1,056 mph to 1,188 mph)

**DIMENSIONS:** 132.1 ft. length, 63 ft. wingspan

**CAPACITY:** 12 passengers, 3 crew

**COST (PROJECTED):** \$2.5 billion development cost; \$80 million per aircraft

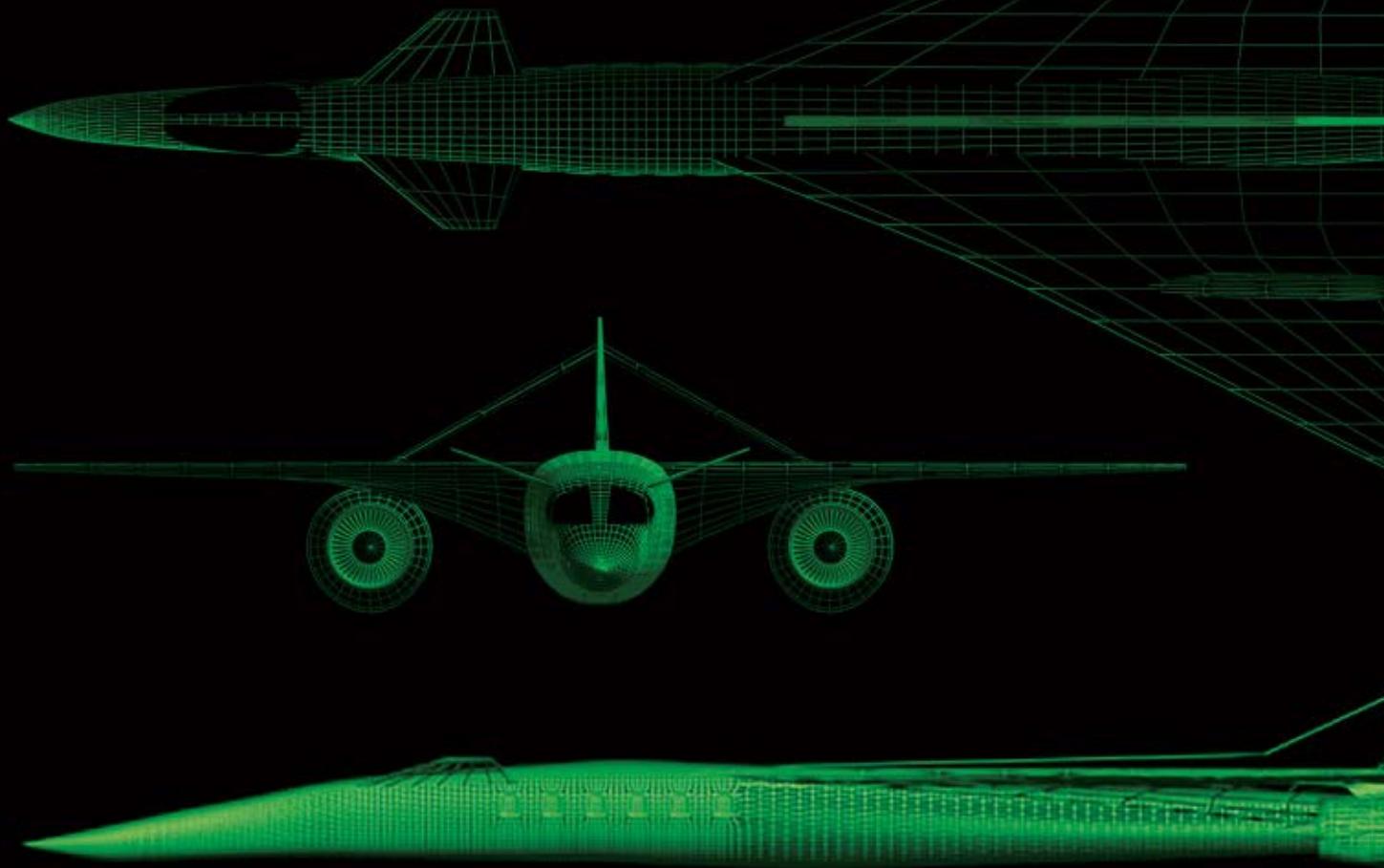
**FIRST FLIGHT (PROJECTED):** 2011

◀ **SKY ROCKET** Sophisticated aerodynamic shaping muffles eardrum-blistering sonic booms, permitting the QSST to fly over land at supersonic speed.



## CONCEPTS & PROTOTYPES

▼ **WEIGHT LIFTING** The QSST's swept wings, forward canards, and tail all generate lift, eliminating the need for a larger main wing that would produce sharper pressure spikes.



**PopSci**  
ON THE WEB

See more pictures at  
[popsci.com/qsst](http://popsci.com/qsst).

47,000 and 57,000 feet with a range of 4,600 miles (Chicago to Rome, for example), and it doesn't need an extended runway. Configured with 12 club chairs, a spacious bathroom and a sweet A/V system, the QSST is aimed at diplomats or executives with plenty of money—but little time—to spare.

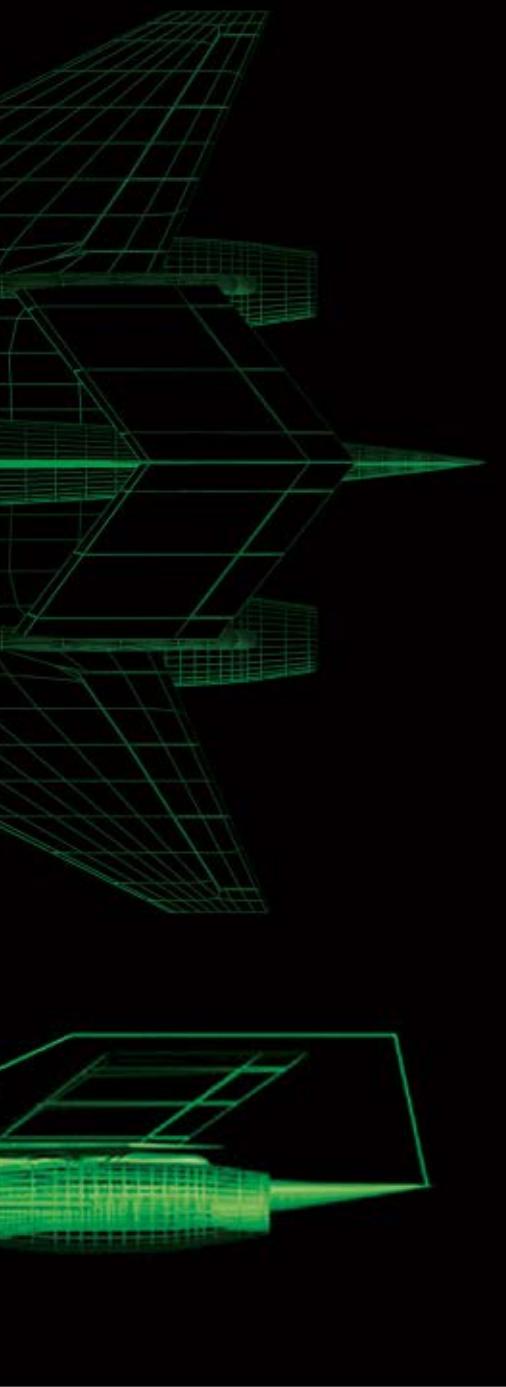
Designed to fly between Mach 1.6 and 1.8 (1,056 to 1,188 mph), the two-engine gull-wing aircraft would leave a sonic wake that's only one hundredth the strength of the Mach 2-capable

Concorde, the 100-seat speed demon that wound up permanently grounded following a fatal accident in 2000. (High maintenance costs for the aging fleet and a struggling airline industry also contributed to its demise.)

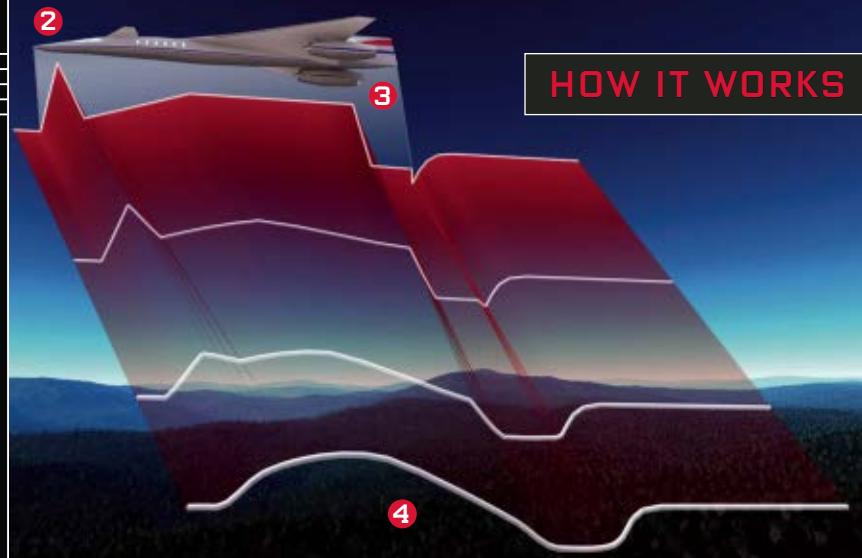
Eliminating bone-rattling sonic booms is a major feat of aerodynamic hocus-pocus. When an aircraft travels faster than the speed of sound, it creates pressure waves in the air that collide with one another faster than they can dissipate, resulting in a loud

crack, or sonic boom. The QSST, though it shares its general shape with the Concorde is less than half the size and uses fine-tuned aerodynamics to control the pressure generated as the plane displaces air at supersonic speeds. With air disturbances along the craft evened out, the QSST generates more shock-waves of smaller magnitude rather than two explosive reports. Tom Hartmann, the program manager at Lockheed, expects the boom to be imperceptible—quieter than a kite flying overhead.

ILLUSTRATIONS BY KRIS HOLLAND



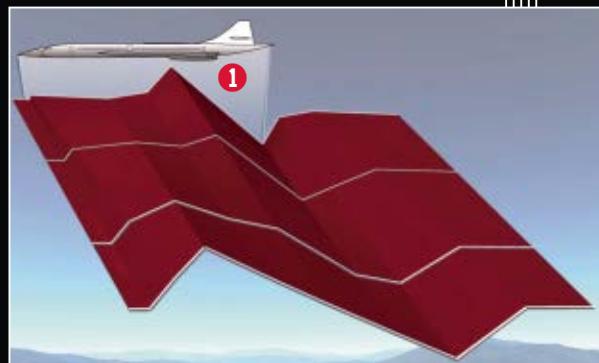
Another key to quiet flight is its broad distribution of lift-generating surfaces. The QSST's canards—the small wings near the front of the fuselage—and swept-V tail provide substantial lift, preventing the sharp, loud-boom-generating pressure change typical of larger, wider wings. Hartmann says the QSST is so sleek that it can fly 10 percent farther on its fuel supply supersonically than it can at subsonic speeds. “We could easily design a low-sonic-boom aircraft if it didn’t have to



## HOW IT WORKS

**WAVE FORM** Sonic booms happen when pressure builds up too fast around wings and engines. In a conventional boom [right], the pressure migrates forward and backward. That movement generates two pressure spikes at the front and rear, creating a classic N-shaped-wave [1], and the result is a loud double bang. To soften the boom, QSST aerodynamicists sought to spread out the pressure points along the fuselage [left].

The new aircraft [above] generates only moderate shocks at the nose [2] and tail [3] with no spike in the middle. The stretched nose creates a small but distinct pressure spike at the front, as does the rear engine placement. These two small spikes counter the tendency of the wave to travel forward and backward. By the time the sound reaches the ground [4], the N-wave has diffused into a barely audible *poof*.



fly anywhere,” he says—that is, if the design didn’t have to take fuel efficiency into consideration. “The challenge is to fly a long way. The hard part of this was to develop a low-drag design.”

The inverted-V tail also allows the two engines to be mounted far aft—a design feature that further separates the pressure waves and keeps them from crashing into one another. Normally, this engine placement would require extra material to support the cantilevered weight, but the inherent strength of the V tail’s truss shape compensates.

The Federal Aviation Administration restricted the Concorde to transoceanic flights because that craft created sonic booms strong enough to rattle dishes on the ground below. Paulson says the QSST will meet the FAA’s stringent new noise regulations, which took effect at the beginning of

2006, and he’s hopeful that the quiet design will prompt a lifting of the ban on overland supersonic flights.

SAI is evaluating engine designs from General Electric, Pratt & Whitney and Rolls-Royce for a unit that produces 33,000 pounds of thrust (on par with a midsize airliner), for 66,000 pounds of total thrust from two engines. Paulson plans to settle on a design in the next year, assemble an international consortium to manufacture the jet, and put it on the market by 2014 for about \$80 million. He’d like to roll out a fleet of 300 to 400 in the next 20 years. “The Concorde was a magnificent aircraft,” Paulson says, “but basically, it was 1960s technology. This is an idea whose time is overdue.”

*Eric Hagerman is working on a book about exercise and the brain for Little, Brown.*

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# HOW 2.0

TIPS, TRICKS, HACKS AND DO-IT-YOURSELF PROJECTS



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Watch free Web video on your TV



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Hide your Wi-Fi gear in a light socket



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Make a musical hiding place for your cash

YOU BUILT WHAT?!

## A HOMEMADE ZAMBONI

In his quest to create the perfect outdoor rink, a hockey fan linked, wired, and welded together an ice-mowing, snow-throwing Frankenstein. Game on!

**DAMIAN RENZELLO** takes backyard skating seriously. He's designed a collapsible rink, built miniature Zambonis, and even modified a lawnmower to shave bumps off the ice. His only remaining foe: snow. But rather than add another weapon to his ice-maintenance armory, Renzello combined his machines to create a multifunctional monster that looks like it came from the Caterpillar factory.

Starting with a four-wheel utility vehicle, he attached a five-foot-wide snowblower

with its own power up front. An electric motor rigged to the chute lets him adjust its aim from inside the cab. A converted lawnmower below the driver's feet chops the ice flat, and hot water flows from a rear-mounted tank to smooth the surface.

To recoup costs, Renzello recently sold the "Bambini" to a family in Lake Tahoe for \$20,000. "One of these days I'd love to have one for myself," he says, "with a full rink and the whole nine yards." —GREGORY MONE

**SMOOTH OPERATOR** Damian Renzello's yellow behemoth is a skater's dream—and Jack Frost's worst nightmare.

### HOW THE BAMBINI WORKS

\$20,000

3 MONTHS

**CLEARING:** Instead of drawing power from the four-wheeler, the snowblower is fitted with its own 18-horsepower gas motor.

**SHAVING:** Renzello cut out the front of a lawnmower and replaced its blades with ones built by a machine shop near his East Montpelier, Vermont, home.

**POLISHING:** A dragging blade wipes away the chopped slush, and hot water melts the top layer of ice to smooth it out.

**LOOKING SHARP** The Bambini can cut grass in the off-season.



**GREEN  
TECH** **DIY  
JUICE  
POUCH**

Keep your gadgets powered up with an easy mod to a messenger bag—and help from the sun

**DEAD BATTERIES** are the scourge of cellphone jockeys and iPod people everywhere. But you can avoid volt loss by charging your gadgets while you carry them. Just equip an old messenger bag with a lightweight, weather-proof solar panel, a simple connector and a few electronic bits, and the sun will do the rest. With a panel this small, don't expect to fully restore a dead iPod in an afternoon, but an hour of light can top off a semi-charged battery or create enough juice to make a call. (You don't even have to be outside—just set the bag near a sunny window.) No more suffering in silence.—DAVE PROCHNOW



**BUILD A SOLAR BAG**

**2 HOURS**

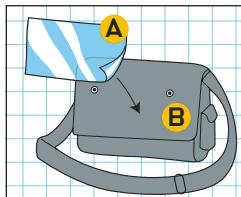
**\$45**

**EASY** **HARD**

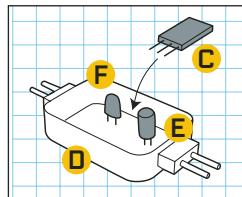
**PARTS** (Find electronics at [jameco.com](http://jameco.com); see [popsci.com](http://popsci.com) for part numbers)  
**A.** Vinyl sheet 50¢  
**B.** Grommet kit \$2.45

**C.** Voltage regulator 19¢  
**D.** Plastic project box free (salvaged)  
**E.** Electrolytic capacitor (0.47µF 50V) 4¢

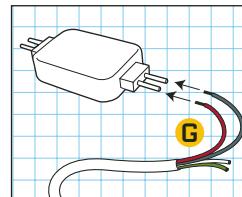
**F.** Tantalum capacitor (0.1µF 50V) 31¢  
**G.** USB cable \$1.65  
**H.** Solar panel \$40  
**I.** Bag free (salvaged)



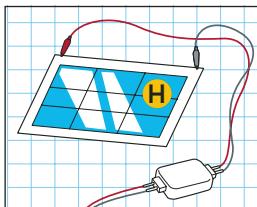
**1.** Make a clear pocket out of the **vinyl sheet**. Add **grommets** for running wire to your charging pocket.



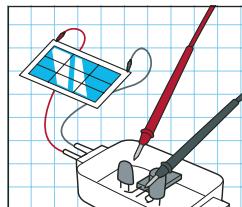
**2.** Place the **voltage regulator** inside the **plastic box**, and solder it to the **capacitors** (see [popsci.com](http://popsci.com) for diagrams).



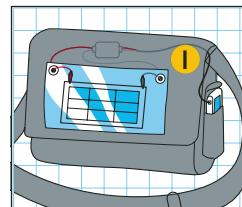
**3.** Snip the **USB cable's** male end. Connect the red and black wires to the voltage regulator. (Green and white are not used.)



**4.** Solder wires to the voltage regulator, and clip the other ends to the **solar panel**.



**5.** In direct sunlight, test the panel's voltage with a multimeter. You want 5.15 volts from the USB plug.



**6.** Stuff the parts inside your **messenger bag**, plug in a gadget, and head for the sun.

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# MOVE VIDEO FROM THE WEB TO YOUR TV

Take advantage of all there is to watch on the Web—from the comfort of your couch

**WHO NEEDS CABLE ANYMORE?** The networks stream their biggest shows online, you can buy dozens of others through iTunes, get movies from Amazon, and even see free documentaries at *pbs.org*, not to mention YouTube and video podcasts. To liberate all that content from your monitor and get it to the TV, you could buy or build a computer that sits in your living room (usually called a home-theater PC) or pick up a dedicated streaming device, which sends video over your home network. Or you could go the simple and cheap route with one of these two basic but often overlooked media-moving methods.—MIKE HANEY



## TWO WAYS TO GET ONLINE VIDEO TO THE LIVING ROOM

### DIRECT CONNECTION

**PRO:** Inexpensive (cables run \$10 to \$20)  
**CON:** Computer must be fairly close to the TV

1. Check your computer for a video-out port. A round one with several holes is probably an S-video connection; a rectangle is for DVI, which can carry HD video.
2. Find a video-in port on your TV or cable box, and buy the proper cable (try *cablestogo.com*). You may also need an audio cable running from your computer's headphone jack to your TV or receiver.
3. Push your set's "source" or "TV/VCR" button, and you'll see what's on your computer screen. Unless your TV is high-def, change your computer's resolution to 640x480. If you can, switch to full-screen mode.



### MEDIA HARD DRIVE

**PROS:** Easy to hide in the living room; can hold hundreds of hours of video  
**CONS:** Only works with downloaded videos, not streaming media; more expensive

1. Buy a hard-drive case that has A/V ports and can play video (search "media enclosure" at *froogle.com*). Models start at around \$75 and go up to \$270 for the MediaGate MG-350HD [right] (*zipzoomfly.com*), which wirelessly pulls files off your computer.
2. Put a hard drive in the enclosure (try *dealnews.com* for bargains). Attach it to your computer and fill it with video files.
3. Connect the enclosure to your TV. Navigate the onscreen menus with the included remote to play your flicks, photos





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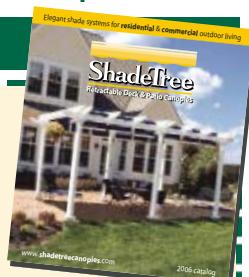
For a **FREE** on-line cost estimate, visit:  
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## BUILD A WI-FI LIGHT SOCKET

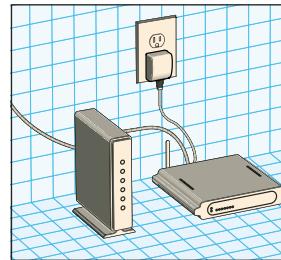
4 HOURS

\$133.50 (EACH ADDITIONAL WI-FI SOCKET, \$63.50)

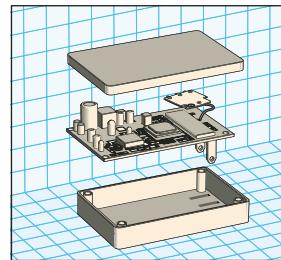
EASY     HARD

### PARTS

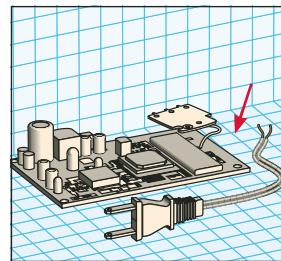
- A. Trendnet Powerline Router TPL-111BR** (\$70; [newegg.com](http://newegg.com))
- B. Trendnet 802.11g Wireless Powerline Access Point TPL-110AP** (\$60; [mwave.com](http://mwave.com))
- C. Plug-base socket adapter** (\$1.50; hardware store)
- D. Twin light socket** (\$2; hardware store)



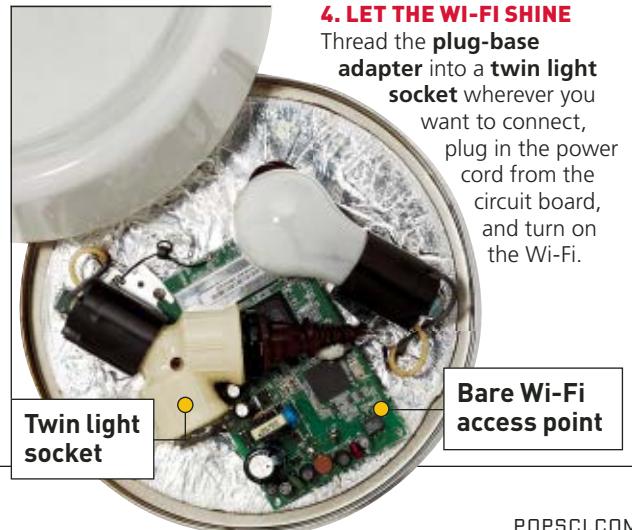
**1. SET UP THE NETWORK**  
Connect a **powerline router** to your cable or DSL modem, and plug it into any wall outlet. This will take the signal from the modem and feed it into your house's wiring. (If you already have a wireless router, plug the powerline router into that.)



**2. GUT THE BOX**  
Carefully open the **access point** and remove the circuit board from its enclosure. Snip the four plastic posts holding the Wi-Fi antenna (it's a flat piece of metal) to the inside of the enclosure. Reattach the antenna to the circuit board.



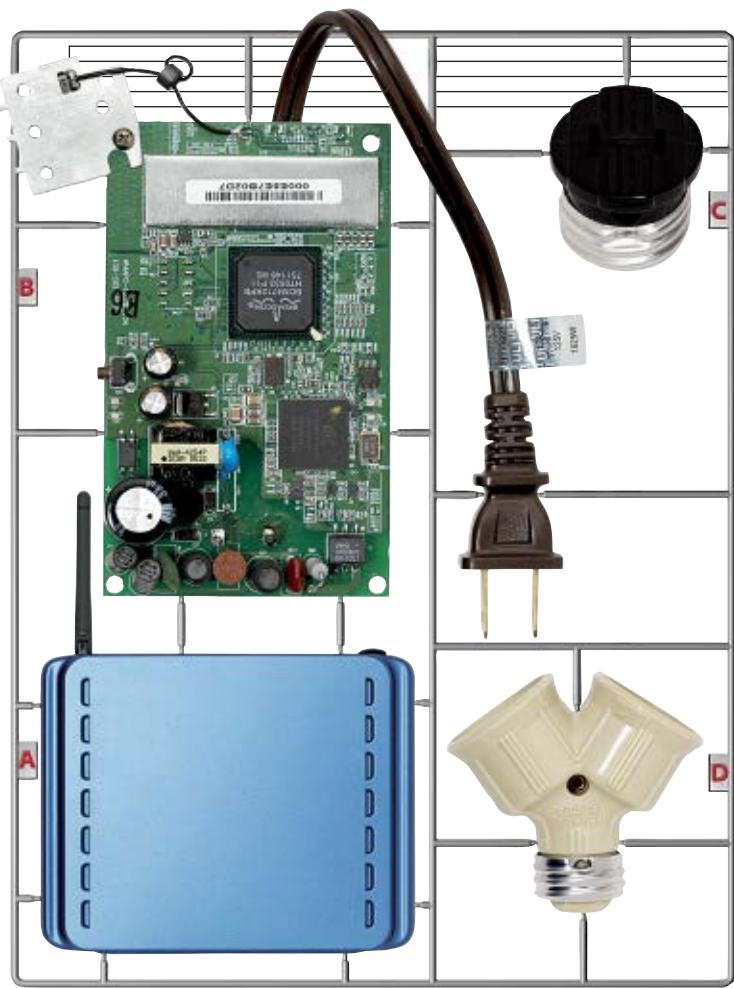
**3. GIVE IT POWER**  
Cut a short length (about four inches) from the plug end of an extension cord. Remove the two power-plug prongs from the circuit board and solder the length of cord in their place.



**4. LET THE WI-FI SHINE**  
Thread the **plug-base adapter** into a **twin light socket** wherever you want to connect, plug in the power cord from the circuit board, and turn on the Wi-Fi.

Twin light socket

Bare Wi-Fi access point



# BUILD IT HIDE YOUR WI-FI AWAY

Spread wireless Internet around your house without a trace using the Wi-Fi light socket

**SO YOU WANT** to surf the Web in the upstairs bedroom, but your wireless network doesn't reach that far? Screw this Wi-Fi "lightbulb" into any fixture, and it will pick up your Internet signal through the electrical wiring (using powerline networking) and rebroadcast it to the room.

Besides being out of sight, a signal sent from the lights above will be faster and stronger than one from a router stuck in a corner, because there are fewer obstructions to your computer. Just remember that when you turn the light out, the Wi-Fi goes dark, too.—DAVE PROCHNOW

## WHAT IS POWERLINE NETWORKING?

It means using your home's electrical wiring to carry an Internet signal. You'll need a powerline-enabled router to feed the signal into the lines from your modem. Then plug an adapter into an outlet, and it will send out the signal wired or wirelessly.

ILLUSTRATIONS: FROM LEFT: PAUL WOOTTON; STEVEN KARP (3); PHOTOGRAPHS: LUIS BRUNO

# INTRODUCING AN AMAZING NEW TECHNOLOGY FOR TURNING BAD AIR GOOD.

**AND ONLY  
ORECK HAS IT.**

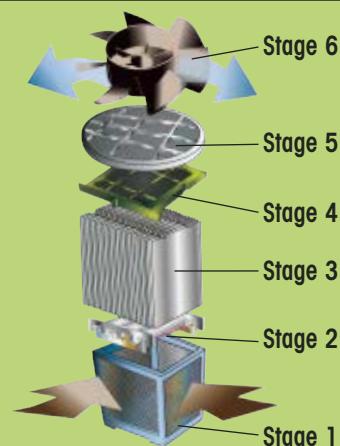
**THE NEW ORECK XL®  
PROFESSIONAL AIR PURIFIER  
WITH THE REVOLUTIONARY  
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Oreck has spent years developing the Truman Cell. This breakthrough technology captures and destroys the bad stuff you might be breathing right now in your home. Could it improve the quality of your life? Without question, it's what makes the Oreck XL Air Purifier the best defense against bad air on the market today.

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It can clean, freshen and circulate every cubic inch of air in an area as large as 1125 sq. ft. every single hour, capturing bacteria, molds, viruses, fungi, even cigarette smoke and other odors you don't want to live with. Including those caused by pets, cooking and toxic chemical



PBY7R



*The XL Tower is 30" high and purifies an 1125 sq. ft. room every hour.*



*The XL Tabletop is 16.6" wide and purifies a 150 sq. ft. room 6 times an hour. Available in Silver/Marble and Black/Burl Wood.*

fumes such as paint smells and off gases from new rugs, which can contain formaldehyde, a carcinogen.

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It will do it quietly, thanks to Oreck's own Silence Technology®, while using as little energy as an ordinary light bulb. Plus, unlike other purifiers, the Oreck XL doesn't require costly replacement filters. It has a permanent filter that is washable. Simply rinse the filter as often as you like and it's as good as new. So try a new Oreck XL Professional Air Purifier risk-free. If you don't love it, you don't keep it.®

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# LINUX ISN'T JUST FOR GEEKS

Ditch Windows and try the free OS—it's easier than you think

**LINUX IS THE THIRD-PARTY** candidate of operating systems, an open-source alternative to Microsoft Windows and Apple's OS. It's little used outside the code-monkey crowd, but many versions (or "distros") look just like Windows and can perform all the same tasks. The only difference you'll notice: Linux doesn't get slowed by spyware, and everything you need is free. Spread the word.—DOUG CANTOR

## WHAT TO DOWNLOAD

There are Linux versions of nearly all Windows programs, some of which may come with your distro. Find these and more at [linux.org/apps](http://linux.org/apps).

HAVE THAT?	GET THIS
Microsoft Office	OpenOffice
Outlook	Thunderbird
iTunes	Banshee
Photoshop	GIMP

INSTALL LINUX	
FREE	1 HOUR
EASY	HARD
<p><b>1.</b> Go to <a href="http://www.linux.org">www.linux.org</a> to find the version, or distro, that fits your needs. (We chose Ubuntu 6.06, one of the easiest to install and use.) See the "courses" area of the site for detailed instructions.</p> <p><b>2.</b> Download the distro (it typically appears as an .iso file), and burn it to a blank CD or DVD. Alternatively, order a pre-burned disc from the distro site.</p> <p><b>3.</b> Enter your computer's BIOS mode (you'll see directions as your computer is booting up). Change the settings to read your CD drive first, so the Linux disc will boot automatically.</p> <p><b>4.</b> Double-click the "install" icon, and follow the prompts. Pay attention to the "partitioning" step, which gives you the option of keeping your old OS or deleting it (and all your data) completely.</p>	

## 5 THINGS...

### THAT CAN HELP YOU GET WORK DONE FASTER

#### 1 SURF SMARTER

Switch your computer's network settings to use OpenDNS (free; [opendns.org](http://opendns.org)), which shortens the time it takes your Internet provider to find and connect you to a Web site. OpenDNS will also protect you from phishing sites and automatically correct common URL typos, such as [popsci.cmo](http://popsci.cmo).

#### 2 FORGET YOUR PASSWORDS

Use KeePass Password Safe (free; [keepass.sourceforge.net](http://keepass.sourceforge.net)) to keep track of the various passwords you use. The software stows them in an encrypted database so you can securely paste your login details into a password box with one keystroke.

#### 3 SKIP THE MOUSE

Moving a pointer around is the least efficient way to do something on your computer. Instead use a keyboard interface like AppRocket for Windows (free; [candyllabs.com/approcket](http://candyllabs.com/approcket)) or Quicksilver for Mac (free; [quicksilver.blacktree.com](http://quicksilver.blacktree.com)) to handle repetitive tasks such as launching an application or starting a new e-mail, without ever taking your fingers off the keys.

#### 4 TYPE LESS

Reduce repetition with TextExpander (\$30; [smileonmymac.com](http://smileonmymac.com), Mac-only), which automatically expands typed abbreviations into any oft-used phrase, like "tlys" to "Talk to you soon."

#### 5 BUY A NEW MONITOR

A recent Apple-funded study found that expanding your screen real estate to show larger areas of spreadsheets and photos can increase efficiency. At the very least, wider or multiple displays save time by allowing you to switch between work and solitaire with fewer clicks.—GINA TRAPANI

LUIS BRUNO; PENGUIN: COURTESY LARRY EWING



Watering chores, water bills! Sweating behind a roaring mower!  
Spraying poison chemicals and digging weeds...



...you can end such lawn drudgery—here's how!



Amazoy is the Trade Mark registered U.S. Patent Office for our Meyer Zoysia Grass.

Mow your zoysia lawn once a month—or less! It rewards you with weed-free beauty all summer long.

# 7 Ways Your Zoysia Grass Lawn Saves You Time, Work, and Money!

## 1 CUTS WATER BILLS AND MOWING AS MUCH AS 2/3

Would you believe a lawn could be perfect when watered just once? In Iowa, the state's biggest Men's Garden club picked a zoysia lawn as "top lawn – nearly perfect." Yet, this lawn had been watered only once all summer to August!

In PA, Mrs. M.R. Mitter wrote "I've never watered it, only when I put the plugs in...Last summer we had it mowed 2 times...When everybody's lawns here are brown from drought, ours stays as green as ever." *That's how zoysia lawns cut water bills and mowing! Now read on!*

## 2 ENDS RE-SEEDING NEVER NEEDS REPLACEMENT

Plug in our zoysia grass and you'll never have to spend money on grass seed again! Since you won't be buying seeds, you won't need to dig and rake—then hope the seeds take root before birds eat them or the next hard rain washes them away.

## 3 NO NEED TO DIG UP OLD GRASS

Plant Amazoy in old lawn, new ground, whatever. Set 1" square plugs into holes in the soil 1 foot apart, checkerboard style. Plugs spread to drive out old, unwanted growth, weeds included. Easy instructions with your order. If you can put a cork into a bottle, you can plug in Amazoy.

## 4 FOR SLOPES, PLAY AREAS, AND BARE SPOTS

You can't beat Amazoy as the low cost answer for hard-to-cover spots, play-worn areas, or to end erosion on slopes.

## 5 IT STAYS GREEN IN SPITE OF HEAT AND DROUGHT

"The hotter it gets, the better it grows!" Plug-in zoysia thrives in blistering heat, yet it won't winter kill to 30° below zero. It just goes off its green color after killing frosts, begins regaining its green color as temps. in the spring are consistently warm. Of course, this varies with climate.



Thrives from part shade to full sun.

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Read a guarantee no grass seed can match!

Won't Winter Kill. Amazoy has survived temperatures to 30° below zero!

Won't Heat Kill. When other grasses burn out in summer drought and heat, Amazoy remains luxuriously green.

Any plug failing to grow in 45 days will be replaced FREE! To insure maximum freshness and viability, plugs are shipped not cut all the way through. Before planting, finish the separation with shears or knife. Our guarantee and planting method are your assurance of lawn success backed by more than five decades of specialized lawn experience!

## 6 CHOKES OUT CRABGRASS AND WEEDS ALL SUMMER

Your established Amazoy lawn grows so thick, it simply stops crabgrass and summer weeds from germinating!

## 7 NO NEED TO SPEND MONEY ON DANGEROUS CHEMICALS

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Starting your lawn is easy with our pluggers that cut away unwanted growth as they dig holes for plugs. Both are light, but rugged to help save time, work and effort. The step-on plugger is also an invaluable transplant tool.

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[www.ZoysiaFarms.com/mag](http://www.ZoysiaFarms.com/mag)

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<input type="checkbox"/> 2 Basic Packs + 1 FREE	200	100	—	\$ 23.85	\$15.90	\$ 5.00	30%
<input type="checkbox"/> 4 Basic Packs + 2 FREE	400	200	Free Step-on Plugger	\$ 56.65	\$31.80	\$ 7.50	40%
<input type="checkbox"/> 5 Basic Packs + 3 FREE	500	300	Free Step-on Plugger	\$ 72.55	\$39.75	\$10.00	42%
<input type="checkbox"/> 6 Basic Packs + 4 FREE	600	400	Free Step-on Plugger	\$ 88.45	\$47.70	\$12.50	44%
<input type="checkbox"/> 9 Basic Packs + 7 FREE	900	700	Free Power Plugger	\$ 152.15	\$71.55	\$15.00	50%
<input type="checkbox"/> 10 Basic Packs + 9 FREE	1000	900	Free Power Plugger	\$ 176.00	\$79.50	\$17.50	54%
<input type="checkbox"/> Extra Step-on Plugger				\$8.95			
<input type="checkbox"/> Extra Power Plugger for 3/8" Drill				\$24.95			

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Dept. 916

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Visa

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Name \_\_\_\_\_

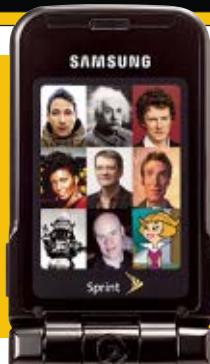
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## CELLPHONE TRICK OF THE MONTH



### SPEED-DIAL CHEAT SHEET

**YOUR CELLPHONE'S** speed-dial function is a nifty shortcut—in theory. But who can remember which number goes with which person? Instead, use an image-editing program to put pictures of your contacts in a 3x3 grid representing the 1 through 9 buttons on the keypad. Upload the file to your cell (search [howardforums.com](http://howardforums.com) for instructions), set it as your wallpaper, and you'll be built for speed. —**DUG CANTOR**

## THIS IS BROKEN



So . . . should I just turn in place?

Find more things broken at [thisisbroken.com](http://thisisbroken.com).

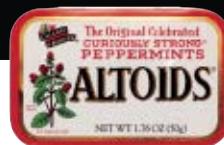
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**DIY: 1.** Remove the electronic noisemaker from a musical greeting card. **2.** Attach it to the inside of an Altoids tin so that it goes off when the lid is opened. **3.** Listen for thieves.

**HAVE AN IDEA FOR A 5-MINUTE PROJECT?** Send it to us at [h20@time4.com](mailto:h20@time4.com).



## ASK A GEEK



# IS THE MUSIC INDUSTRY STILL SUING PEOPLE?

**YOU BET.** Since September 2003, the major record companies, including EMI and Warner Bros., have been suing adults and children alike for sharing music through software like Kazaa, Morpheus and LimeWire. The industry recently stopped disclosing national figures, but as of last spring it had announced lawsuits against more than 18,000 people, and representatives confirm that the legal campaign continues.

What happens to those who are sued? The record companies generally offer to settle for around \$5,000, so most cases never make it to court. So far, the lawsuits have targeted only people uploading files (that is, making files available to other users), although many file-sharing programs do this by default. To stay off the industry's radar, disable "sharing" in your program or just remove offending files—anything copyrighted—from "shared" folders. Be extra careful with BitTorrent software, which automatically uploads files as they're downloaded. If you do get a notice, consult an attorney who specializes in copyright law as soon as you can to discuss your legal options.

FRED VON LOHMANN is a senior staff attorney with the Electronic Frontier Foundation ([eff.org](http://eff.org)), a nonprofit cyber-liberties organization based in San Francisco.

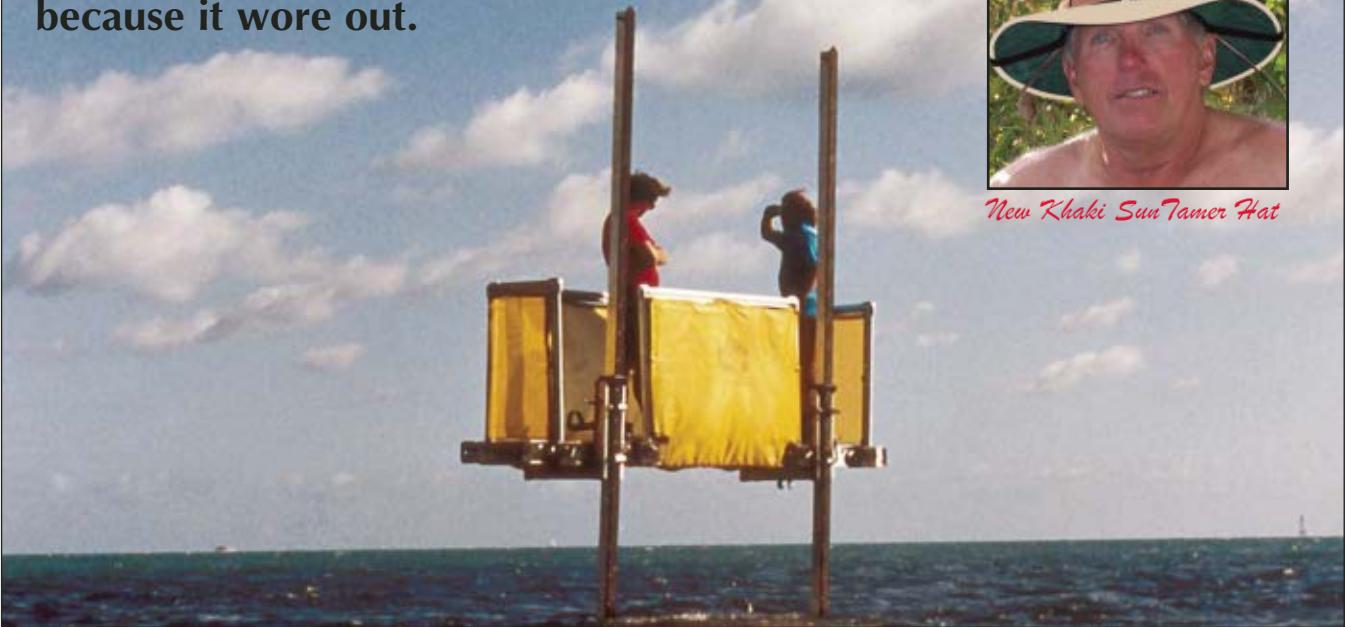
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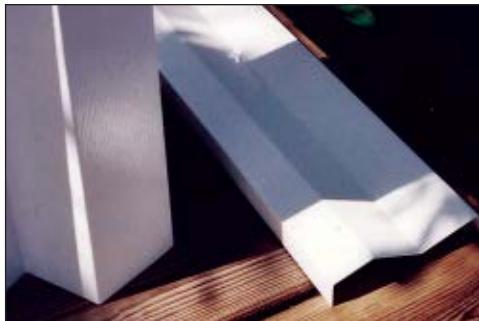
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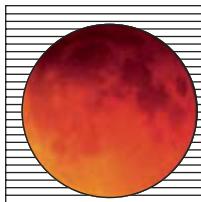
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\*March 2003, DL Laboratories.

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# FYI

**82**  
Did Grandma's diet make my hair brown?



SOMETIMES YOU JUST NEED TO KNOW



**SAY "CALCULUS"!** This photographer clearly used the simple  $1/(1 - xt)^n$  formula for the perfect eyes-open class photo.

## HOW DO I TAKE A BLINK-FREE GROUP PHOTO?

**A** Sitting for those class pictures in elementary school was always a chore, especially considering that half the kids ended up looking asleep, their faces immortalized mid-blink. It turns out that the seventh grade might have been in better hands with a physicist behind the lens than Bob from Sears.

Frustrated with an excess of closed eyes in her photos, Nic Svenson, a communications officer at CSIRO, Australia's national science agency, enlisted the aid of physicist Piers Barnes to develop a mathematical formula for calculating the number of photographs one ought to take to produce a group shot sans blinkers. Barnes's rule— $1/(1 - xt)^n$ —takes into account a person's average number of blinks per second ( $x$ ), the camera's shutter speed

plus the duration of an average blink ( $t$ ), and the number of people in the group ( $n$ ). Simply plug in your numbers and snap away.

Because most photographers can't carry out tricky algebra in their head, Barnes adapted the formula to an easier-to-crunch rule for figuring out the number of photos to take of groups smaller than 20: In good light, divide the number of people by three; in darker conditions, divide by two (with the shutter open longer for a better exposure, there's more time for blinks to creep in).

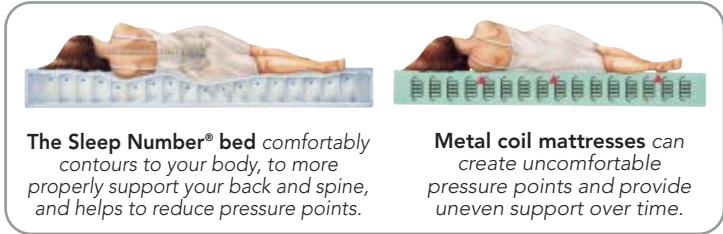
For their efforts, Barnes and Svenson won the 2006 Ig Nobel prize—an annual award that recognizes zany scientific research—for mathematics. Although this bit of math didn't earn a real Nobel, it's an insight you can actu-

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The Sleep Number® bed comfortably contours to your body, to more properly support your back and spine, and helps to reduce pressure points.

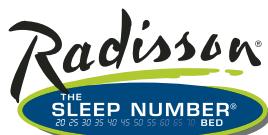
Metal coil mattresses can create uncomfortable pressure points and provide uneven support over time.

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ally use. No word yet on how to calculate the number of photos needed before everyone in the group looks happy, but we're guessing they don't make memory cards large enough.—ABBY SEIFF

## Q Can the food I eat affect my descendants' genes?

**A** Maybe. A recent study suggests that the same vitamins in spinach that perform instant wonders for Popeye's biceps might pack longer-lasting effects, such as dictating the hair color and health of future generations.

Last November, a study led by David Martin, an oncologist at the Children's Hospital Oakland Research Institute in California, tested whether a mouse's diet alone can affect its descendants. The researchers fed meals high in minerals and vitamins—such as B12, which fortifies leafy greens—to pregnant mice that have a gene that makes their fur blonde and also increases the likelihood



**YOU ARE WHAT THEY ATE** Your ancestors' diets might determine your physical traits.

that they will grow obese and develop diabetes and cancer. On the new diet, the mice produced brown-haired offspring that were also less vulnerable to disease. Even when those mice were denied the supplements, their offspring retained the improved health and still grew dark fur coats.

Martin's study isn't the first to note this type of generation-spanning phenomenon. In 2002, Swedish researchers dug through century-old records and determined that a man's diet at the onset of puberty affected his grandson's vulnerability to diabetes. The study tracked 303 men, and those with an abundant supply of food were four times as likely to have grandchildren die of diabetes.

Though far from exhaustive, the study indicates that genes are more susceptible to outside forces than has been commonly believed.

But don't start choking down spinach or putting your teenager on a diet just yet—scientists caution that the influence of specific foods and diets on human gene expression are not fully understood. Nevertheless, Martin says, "the general implication for human health is an obvious one: An external agent can have an effect for a very long time. Given how long human generations last, the environmental exposures experienced by a pregnant mother can still have an effect 100 years later."—A.S.

## Q Is the moon volcanically active?

**A** Claims that the moon was anything other than a cold, dead rock used to be the domain of crackpots. As far as scientists can tell, the last volcanic

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TIME IS IT. Over 92% of people who own exercise equipment and 88% of people who own health club memberships do not exercise. A 4 minute complete workout is no longer hard to believe for all the people who since 1990 have bought our excellent Range of Motion machine (ROM). Over 97% of people who rent our ROM for 30 days wind up purchasing it based upon the health benefits experienced during that tryout, and the ROM performance score at the end of each 4 minute workout that tells the story of health and fitness improvement. At under 20 cents per use, the 4 minute ROM exercise is the least expensive full body complete exercise a person can do. How do we know that it is under 20 cents per use? Over 90% of ROM machines go to private homes, but we have a few that are in commercial use for over 12 years and they have endured over 80,000 uses each, without need of repair or overhaul. The ROM 4 minute workout is for people from 10 to over 100 years old

and highly trained athletes as well. The ROM adapts its resistance every second during the workout to exactly match the user's ability to perform work. It balances blood sugar, and repairs bad backs and shoulders. Too good to be true? Get our free video and see for yourself. The best proof for us is that 97% of rentals become sales. Please visit our website at: [www.FastExercise.com](http://www.FastExercise.com).

### The typical ROM purchaser goes through several stages:

1. Total disbelief that the ROM can do all this in only 4 minutes.
2. Rhetorical (and sometimes hostile) questioning and ridicule.
3. Reading the ROM literature and reluctantly understanding it.
4. Taking a leap of faith and renting a ROM for 30 days.
5. Being highly impressed by the results and purchasing a ROM.
6. Becoming a ROM enthusiast and trying to persuade friends.
7. Being ignored and ridiculed by the friends who think you've lost your mind.
8. After a year of using the ROM your friends admiring your good shape.
9. You telling them (again) that you only exercise those 4 minutes per day.
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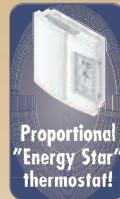
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## PASSING GAS? New evidence suggests that the moon is geologically active.



eruptions on the surface of our steady companion occurred anywhere from one billion to three billion years ago, when the basaltic plains of the lunar seas were formed. Since then, the only changes to the surface were thought to have resulted from a constant bombardment of meteorites.

Last November, however, geologist Peter Schultz of Brown University and his colleagues published a fresh examination of photos from the Apollo missions and data from recent satellite observations of the lunar surface. It revealed a hill on the moon that looked fresher than it should, with an age of no more than 10 million years.

The researchers hypothesize that occasional bursts of gas from surface fissures blow as much as 30 feet of dust off the mile-wide formation, called Ina, hinting at ongoing internal processes not previously suspected. The eruptions, which could have occurred any time in the past 10 million years, could be the product of a still-cooling magma core or pockets of trapped gas rupturing from the moon's crust, but Schultz stops short of crediting volcanic activity for the burps. "These are not explosions of lava coming out, and since we haven't seen [the gas bursts], we don't know if they're hot or not," he says. "But my guess is that this is very likely cold gas that may have been hot deep in the interior."

Schultz's team hasn't yet determined exactly what gases are spewing from the fissures—although NASA's *Lunar Prospector* satellite detected radon, polonium and carbon dioxide near the surface—but he doesn't expect the eruptions to hinder future lunar missions or bases. "In fact," Schultz says, "it might be a good place to go and explore." —TODD NEALE

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— Car and Driver

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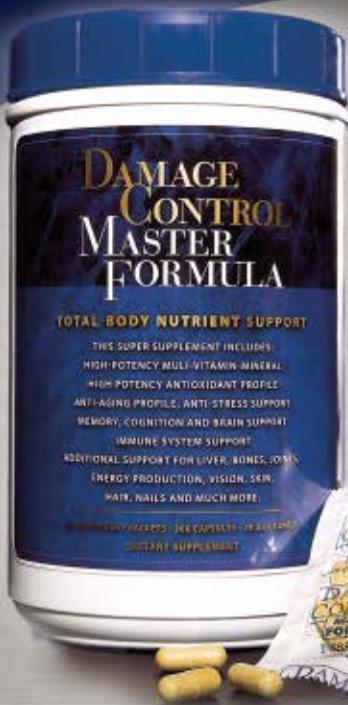
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(CONTINUED FROM PAGE 61)

## THE PROPHET OF GARBAGE

to dumps and landfills was still cheap. Environmental concerns weren't on the public radar the way they are today, and landfills and incinerators weren't yet widely seen as public menaces. "We outsourced the parts to build our first converter," Longo says. "When we told the manufacturers we were working with plasma, some of them thought it had something to do with blood and AIDS."

Longo describes the development curve as "relentless." He teamed up with another engineer who had experience in the waste industry and an interest in plasma technology. "We didn't have computers. We did everything on drafting boards. But I was aggressive. And the more we did, the more it compelled us to continue." It took almost a decade of R&D until they had a working prototype.

"I felt like St. Peter bringing the message out," Longo says of his first sales calls. In 1997 the U.S. Army became Startech's inaugural customer, buying a

converter to dispose of chemical weapons at the Aberdeen Proving Ground in Maryland. A second reactor went to Japan for processing polychlorinated biphenyls, or PCBs, an industrial coolant and lubricant banned in the U.S. since 1977 ("really nasty stuff," Longo says).

Longo realized early on that what would make plasma gasification marketable was a machine that could handle anything. Some of the most noxious chemicals, he knew from his decades in the garbage industry, are found in the most mundane places, like household solid waste. Startech has an edge over some of its competitors because its converter doesn't have to be reconfigured for different materials, which means operators don't have to presort waste, a costly and time-consuming process. To achieve this adaptability, Startech converters crank the plasma arc up to an extremely high operating temperature: 30,000°F. Getting that temperature just right was

one of Longo's key developmental challenges. "You can't rely on the customer to tell you what they put in," Longo says. "Sometimes they don't know, sometimes they lie, and sometimes they've thrown in live shotgun shells from a hunting trip. That's why it's imperative that the Plasma Converter can take in anything."

A video camera mounted near the top of the converter at the Bristol plant gives me a glimpse of the plasma arc doing its dirty work. At a computer station near the converter, Lynch taps a few commands into a keyboard, and a loud hiss fills the room, the sound of steam being released from behind a pressurized valve. "You can use that steam to heat your facility and neighboring buildings," he says proudly. Next to him is an LCD monitor with a live video feed from inside the reactor. A vivid magenta glow fills the screen as I watch the plasma torch vaporize a bucket of cellphones and soda cans. A hopper at the top of the vessel dumps



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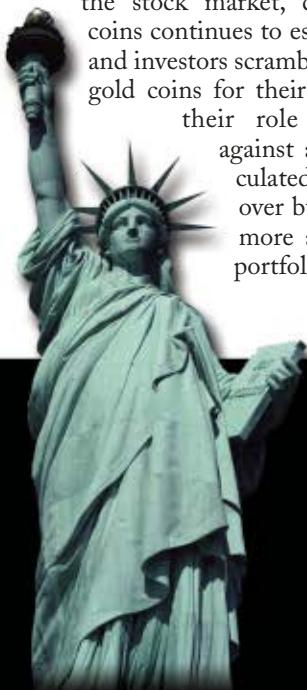
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# THE PROPHET OF GARBAGE

another load into the plasma reactor, and seconds later, it vanishes too. "The idea," Lynch says, "is that regardless of what you put in the front end, what comes out will be clean and ready to use for whatever you want." I've watched him operate the converter for nearly an hour, and I'm still stunned to see no smoke, no flames, no ash, no pollution of any kind—all that's left is syngas, the fuel source, and the molten obsidian-like material.

## CATCHING THE LITTER BUG

Low transportation costs, cheap land, weak environmental regulations—these factors help explain why it took plasma until now to catch on as an economically sensible strategy to dispose of waste. "The steep increase in energy prices over the past two years is what has made this technology viable," says Hilburn Hillestad, president of Geoplasma. His company, which touts the slogan "waste destruction at the speed of lightning with energy to

share," is negotiating a deal with St. Lucie County, Florida, to erect a \$425-million plasma gasification system near a local landfill. The plant in St. Lucie County will be large enough to devour all 2,000 tons of daily trash generated by the county and polish off an additional 1,000 tons a day from the old landfill. Of course, the technology, still unproven on a large scale, has its skeptics. "That obsidian-like slag contains toxic heavy metals and breaks down when exposed to water," claims Brad Van Guilder, a scientist at the Ecology Center in Ann Arbor, Michigan, which advocates for clean air and water. "Dump it in a landfill, and it could one day contaminate local groundwater." Others wonder about the cleanliness of the syngas. "In the cool-down phases, the components in the syngas could reform into toxins," warns Monica Wilson, the international coordinator for the Global Alliance for Incinerator Alternatives, in Berkeley, California. None of

this seems to worry St. Lucie County's solid-waste director, Leo Cordeiro. "We'll get all our garbage to disappear, and our landfill will be gone in 20 years," he tells me. The best part: Geoplasma is footing the entire bill. "We'll generate 160 megawatts a day from the garbage," Hillestad says, "but we'll consume only 40 megawatts to run the plant. We'll sell the net energy to the local power grid." Sales from excess electricity might allow Geoplasma to break even in 20 years.

In New York, Carmen Cognetta, an attorney with the city council's infrastructure division, is evaluating how plasma gasification could help offset some of the city's exorbitant waste costs. "All the landfills around New York have closed, incinerators are banned, and we are trucking our trash to Virginia and Pennsylvania," he explains. "That is costing the city \$400 million a year. We could put seven or eight of these converters in the city, and that would be enough." The

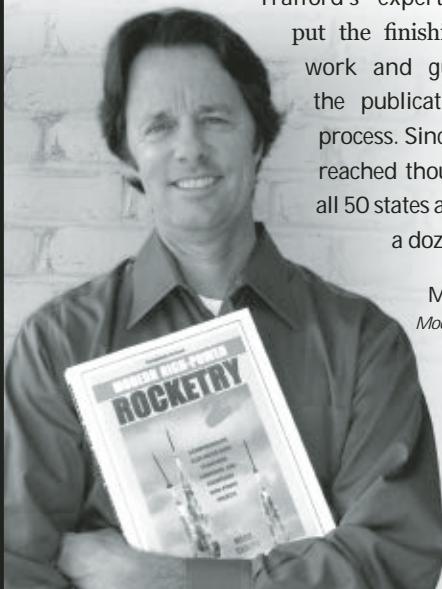
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# THE PROPHET OF GARBAGE

syngas from the converters, Cognetta says, could be tapped for hydrogen gas to power buses or police cars. But the decision-making bureaucracy can be slow, and it is hamstrung by the politically well-connected waste-disposal industry. "Many landfill operators are used to getting a million dollars a month out of debris," says U.S. Energy's Paul Marazzo. "They don't want a converter to happen because they'll lose their revenue."

Meanwhile, Victor Sziky, the president of Sicmar International, an investment firm based in Panama, is working with the Panamanian government to set up at least 10 Startech systems there. "The garbage problem here is exploding in conjunction with growth," says Sziky, who lives in Panama City. "We have obsolete incinerators, and landfills that are polluting groundwater and drinking water. We've had outbreaks of cholera and hepatitis A and B directly attributed to the waste in landfills. There

are a lot of people in a small country, and there's no infrastructure to deal with it." The project will be capable of destroying 200 tons of trash a day at each location, enough to handle all the garbage for the municipalities involved—and, says Sziky, to produce up to 40 percent of their electrical demand.

Panama's syngas will probably be converted to hydrogen and sold to industrial suppliers. The current market for hydrogen is at least \$50 billion worldwide, a figure that is expected to grow by 5 to 10 percent annually, according to the National Hydrogen Association, an industry and research consortium. Analysts at Fuji-Keizai USA, a market-research firm for emerging technologies, predict that the domestic market will hit \$1.6 billion by 2010, up from \$800 million in 2005. The Department of Energy's Patrick Davis says that when the long-awaited hydrogen-powered vehicles finally arrive, the demand for hydrogen

will soar. But he also notes that to have an effect on global warming, it's critical that hydrogen come from clean sources.

That's one more idea that's old news to Longo, who, as usual, is 10 steps ahead of the game, already embedded in a future where fossil fuels are artifacts of a bygone era. For the past several years, he has been developing the Starcell, a filtration mechanism that slaps onto the back end of his converter and quickly refines syngas into hydrogen. As he says, "We are the disruptive technology." Longo has been working in garbage for 40 years, making his fortune by literally scraping the bottom of the barrel. Which is, it turns out, the perfect vantage point for finding new ways to turn what to most of us is just garbage into arguably the most valuable thing in the world: clean energy.

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# “The Amazing Exercise Program That Transforms Couch Potatoes into Super-Hero Fitness Machines”

It doesn't matter how OLD you are. It doesn't matter how out of shape you are. **Combat Conditioning** will turn your life around.

By Matt Furey

Best-selling author of *Combat Conditioning*

I was the total skeptic. Not only had I lifted weights and run long distance for years, but I had major success under my belt, including a world kung fu championship and a national collegiate wrestling title.

So I just didn't want to believe what Karl, a 76-year old man told me about exercising WITHOUT weights... and WITHOUT long-distance running.

Most importantly, I didn't want to hear that a good exercise program only took a few minutes. Hate to admit it, but I was addicted to the “hard work or nothing” mentality and refused to believe you could get into the best shape of your life by doing LESS... not more.

Let me tell you, when I looked at this so-called “old man's” physique and watched him demonstrate his exercises, I could not look the other way. I had to check them out for myself, even if it meant saying, “Okay, I've wasted a lot of time doing it the wrong way.”

### What I discovered shocked me from head to toe!

Before I met Karl I THOUGHT I was strong. I thought I was tough. But the exercises he gave me exploited every weakness that weights and running could not cover. In a matter of minutes, I knew Karl “had me.”

So I gave up the weights and began a routine of bodyweight calisthenics called **Combat Conditioning**. After all, when a man of 76 can do things that a 36-year old cannot do, that tells you that “Yes, there's gold in them there hills.”

The exercises I learned had such a profound and dramatic effect on me, that for six years I have been introducing men and women of all ages and of all backgrounds to this extraordinary program – and the results are shocking, awe-inspiring and PROOF that this system works, and works FAST.

### Who is Combat Conditioning for?

**It's for** the hard-working man or woman who often finds it difficult to squeeze in a quick workout.

**It's for** the traveling executive who sleeps in hotel rooms more than at home.

**It's for** those who have trained their whole lives on weights.

**It's for** athletes, martial artists and the military.

And .. **IT'S FOR** the man or woman who hasn't done a lick of exercise in decades.

### Even One Minute a Day Brings Results!

Unlike other exercise program where you are told you **MUST** do 30 minutes of cardio per day and an hour of weights, to get results, **Combat Conditioning** is totally different. 15 minutes is all it takes to whoop the hard-core trainee. But for the total beginner, he or she can get results starting with **ONLY** one minute a day. And no, this is not a joke.

### Time is not the issue!

Forget all those workouts that take all day. With **Combat Conditioning**, all that's required is your own



#### Matt Furey

won a national collegiate wrestling title in 1985 and a world shuai-chiao kung fu championship in 1997. Furey has a knack for taking the average and ordinary person and transforming him with his powerful programs. Furey was inducted into the Edinboro University Athletic Hall of Fame in 1998 and spends much time each year traveling throughout the world, searching for the very best information available to his world-wide audience. His website, [www.mattfurey.com](http://www.mattfurey.com), is one of the finest in the world, giving valuable information that changes lives.

body and a tiny “get started NOW” decision to DO a little something each day.

The key to your success is in the magical, transformative power of these exercises – not in your belief system about hard work. For many people, just one rep is all they can do at first, and they're shaking like a leaf on a windy day in Chicago. And so, that's all that person should do at first. Even if you think you're not doing enough – the exercises work their magic anyway. Your body has it's own intelligence and will work FOR YOU if you'll simply get out of the way and let it.

When you do, pretty soon you'll be the type of person who can do 2, 4, 8, 16, 32, 64 or 128 repetitions and feel no fatigue. Instead of tiredness you'll feel exhilaration and ENERGY. You're building strength and endurance from the INSIDE-OUT. And believe me, once you can do more than a few reps, inches of unsightly fat and pounds of excess flab will fly off your body at break-neck speed.

### New Results from Forgotten Exercises

Are the exercises in **Combat Conditioning** NEW? Well, not really. They go back about 5,000 years – but for the most part, they got lost in the shuffle when weights, gadgets and gyms came around. So although they aren't NEW, they're “New to YOU!”

Before I learned these exercises, I read about the Great Gama of India, a wrestler who followed this program and was unbeaten in 5,000 matches. I also read that the legendary Bruce Lee did these exercises, too. And we all know about Lee's incredible martial arts skills. Then there was the All-Pro NFL running back, Hershell Walker, who did bodyweight exercises each day. The list goes on and on. The key is in having a proven program with a track record, and **Combat Conditioning** is just that.

### Puts You into the Old Clothes You Dream of Wearing Again!

The main reason why **Combat Conditioning** works is because it targets all the weak links in your body. And when all those weak links are given a little attention, your entire body gets stronger, faster, more powerful and more energetic. Spend time each day doing a few functional exercises and the payoff is HUGE.

You get functional strength, endurance and flexibility – all at the same time. Not to mention seeing the excess inches flying off your body, making it easy for you to fit into the clothes you dream of wearing again. Stop dreaming. Start DOING. And get results.

### 12 Ways Combat Conditioning Will Change Your Life!

Follow this program and your body is going to change big time. In fact, I've made a list of 12 of the most powerful benefits that hundreds of thousands of others all over the world have gotten from the **Combat Conditioning** program. Let's take a look:

1. **Cranks up your metabolism so you**

**burn excess body fat a lot, lot faster. This means fitting into the clothes you WANT to wear.**

2. Packs attractive and healthy functional muscles (not grotesque) onto your entire body
3. **Simultaneously doubles your strength and flexibility – and does so without needing separate workouts for each.**
4. Quadruples your endurance inside of 30 days. Never get tired again.
5. **Within a couple weeks, it often eliminates chronic back and shoulder pain from years of heavy squats, deadlifts and bench pressing – or other forms of abuse.**
6. Sleep like a log. Eight hours of deep sleep is no longer a goal. It's automatic. As soon as you hit the rack you're out like a light.
7. **Your self-confidence will have no bounds. Especially when you get compliments from people who hardly paid attention to you before.**
8. You can train anywhere. You don't need more than a few square feet of carpet or pavement and you're all set. You don't need equipment. Just your own bodyweight.
9. **You get a kick-butt workout done in 15 minutes or less.**
10. You'll turn back the clock. Friends may tell you that you look 5–10 years younger.
11. **You'll have an explosive type of strength that weights cannot give you. Your every movement will be lively and full of vigor.**
12. Your muscles will be pliable and powerful, like a tiger's.

### Here's How to Order

**Combat Conditioning: Functional Exercises for Fitness** has 48 super effective bodyweight exercises along with seven different programs that will get you into kick-butt shape fast. Order NOW and you'll receive 3 free Special Reports on how to eliminate knee, back and shoulder pain. Your total investment in this no-nonsense book is only \$29.95 plus \$6 S&H U.S. (foreign orders add \$12). Order online at [www.mattfurey.com](http://www.mattfurey.com).

Or pick up the phone right now and call 1 813 994 8267 to order. You can also send a money order to Matt Furey Enterprises, Inc., 10339 Birdwatch Drive, Tampa, FL, 33647.

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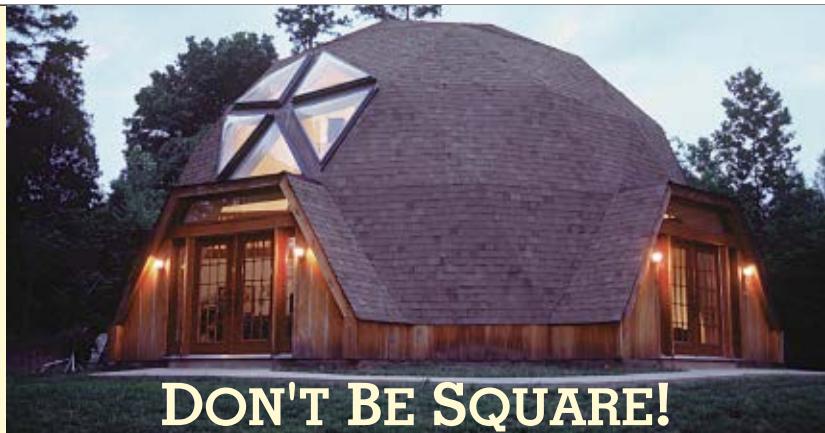
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Dr. Steffanie Seaver PSY.D is an expert in the area of interpersonal relationships. Researcher, author and accomplished public speaker, she has lectured nationwide for over a decade. Dr. Seaver has also been involved with several publications covering relationship and lifestyle issues.

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# Can this “Secret Formula” Really Improve Your Stamina and Performance?

## Ask Steffanie:

**Hey Fellas - If YOUR “Timing” issues are keeping you from performing at your best then read this letter that reveals the stamina secret that keeps you out of the penalty box and in her zone!**



### Dear Steffanie,

I know a lot of men read your column and could really benefit from this important STAMINA secret my husband and I recently discovered.

As much as I hate to throw him under the bus, my husband’s performance was less than adequate when it came to his “timing”. He tried hard to please me and I can tell that he believed he was doing a great job, which is why it was difficult for me to tell him the truth.

Last month, after what he thought was a “strong effort” for a Saturday afternoon, I couldn’t help but be disappointed and I let him know there could be a bit of a gap between his perception of his performance and the reality of our intimate relationship. If our timing could only be more in sync.

He said he always thought that when he “punched the clock”, he was pulling a “full shift.” Of course, he was shocked by this huge blow to his ego but after some serious sulking and a whole lot of denial, he realized his stamina really could use some improvement.

He was serious about improving his performance so he did some research and spoke to a doctor friend of

**“ I know he feels great knowing I’m completely satisfied and HE’S the reason why. ”**

his. His friend told him about a number of cheap desensitizing lubricants on the market that might help his stamina and performance but were known to possibly hurt virility and worse, they tend to numb a woman – which as far as I’m concerned, defeats the whole purpose! Great, so now he’d be able to last longer but I’d be numb too! That was the last thing our relationship needed!

His doctor friend also told him that if he really wanted to improve his control and performance and still maintain maximum virility, he should try a new product called **Vivaxa from the makers of Maxoderm (the #1 topical male enhancement product that’s recommended by Leading Physician, Michael A. Savino, M.D., F.A.C.S. for instantly improving virility quality). The ingredients in this new “stamina secret” make it different from other products because it contains a clinically tested ingredient that is unlike anything else on the planet! It actually HELPS virility quality. And best of all, the formula**

**absorbs super fast upon application so it won’t numb a woman! Improved virility AND enhanced stamina – it seemed too good to be true!**

My husband got a sample and that weekend we tried it. From the very first application, he felt more virile than ever before – by the time we’d finished making love, I’D GOTTEN MINE TWICE! Needless to say, this has been a record breaking month for us. I know he feels great knowing that I’m completely satisfied and he’s the reason why. Let’s just say his confidence wasn’t the only thing that shot through the roof!

So Steffanie, please print this letter – I’m sure there’s a ton of women out there wishing their men used Vivaxa, a quality control and performance enhancing product that lets him put in the extra time without numbing her! I know they’re still offering a **FREE MONTH SUPPLY** if you call **1-800-451-1327** or visit their website at **www.vivaxa.com**. Tell your readers to hurry because supplies were limited when I called.

Pamela B., Nashville, TN

### Dear Readers,

I did some research on Vivaxa and here’s what I found: Vivaxa uses groundbreaking, advanced topical technology. It’s the first sexual performance and control enhancer on the market to utilize Calmosensine™, along with Peptide 171. It soothes overstimulation to help men significantly enhance stamina and performance without desensitizing female partners. Check out Vivaxa by calling **1-800-451-1327** or visit **www.vivaxa.com** and receive a **FREE TUBE PLUS** get **\$200 worth of FREE GIFTS** with your order – **FOR A LIMITED TIME**. Don’t let her question your staying power anymore. Call today! **GUARANTEED OR YOUR MONEY BACK!**



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Winnifred Cutler, creator of 10X and 10:13

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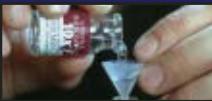
**MESSAGE FROM DR. CUTLER**

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Dr. Cutler has a Ph.D. in biology from University of Penn. post-doc at Stanford. Co-discovered human pheromones in 1986 (Time 12/1/86; and Newsweek 1/12/87).

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warned about cigarettes and pure water products. Although we sell thousands of machines, those that don't listen may become victims of their own folly! Since we are engineers, not doctors, visit our website ([www.johnellis.com](http://www.johnellis.com)) and read the signed letters. You will know why government officials, including Senators, are regular visitors to our 418 acre estate and Research Center celebrating this patented discovery! It may save your life!

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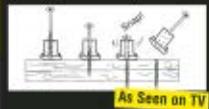


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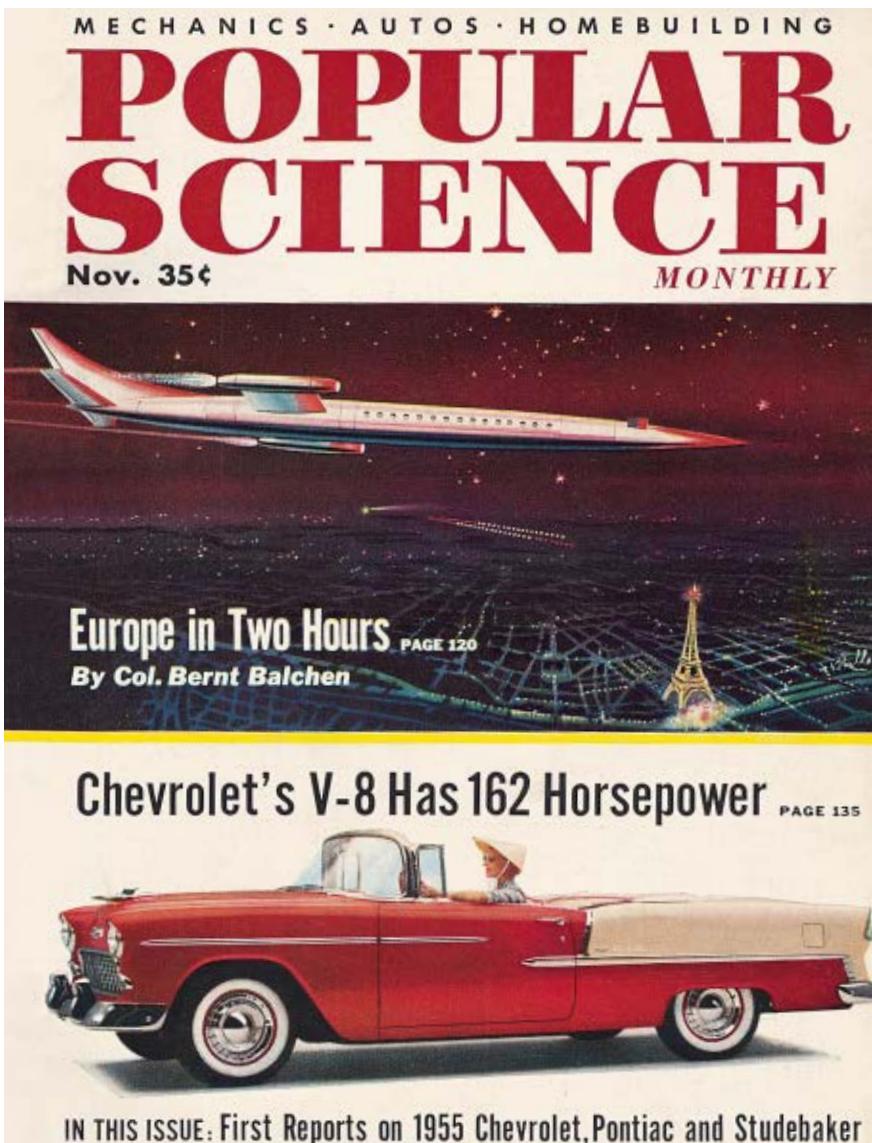
FROM THE POPULAR SCIENCE ARCHIVES

NOVEMBER 1954

## Supersonic Dreams

For more than 50 years, aircraft designers have predicted a faster future

In the early years of the Cold War, Russia and the West were fighting for supersonic supremacy—and dreaming of the future of airline travel. “No long-distance flight in 1980–1990 will take more than a couple hours,” one adviser to the Air Force predicted. The airliner of the future, he wrote, would reach a cruising speed of 8,000 mph (Mach 12). To combat the friction heat at such high speeds, it would have a glass exterior and wells of liquid helium to cool its surface. The first (and only) supersonic passenger planes—the Russian TU-144 and the Anglo/French Concorde—first took off in 1968 and 1969, respectively. They have since been retired. But there’s a new craft on the horizon [see “All Sonic, No Boom,” page 64].—KATHERINE RYDER



### OTHER STORIES FROM THE NOVEMBER 1954 ISSUE



#### SURFING REVOLUTION

“When Dick McGinley and Alan Rosen-dahl hanker for a little surf hopping, they’re never beached for lack of a tow,” we wrote of two Floridians and their revolutionary “motorized surfboards.” By 1973, the craft was modernized and sold nationwide as the Jet Ski.

#### HOT ROD

Called the “turbo-fire,” the 162-horsepower, 265-cubic-inch V8 engine that Chevy introduced in 1955 was the company’s first V8 in 35 years. That was powerful for the time, but the “restless owner, who is not wholly satisfied with his V8’s innate horsepower,” we observed, could upgrade to a four-barrel carburetor and dual-exhaust system that would “boost the horsepower to 180!”

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