



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

# EXTREME LED THROWIES

Build these cheery, magnetic lights — then make them swim, fly, and defy the weather.

The LED “Throwie” was invented around 2005 as a kind of electronic graffiti. It’s a little LED light with a strong magnet taped to it. They’re fun — you throw them onto metal surfaces and they stick there and stay lit up for days, or even weeks. They’re easy, and people love making them.

Since we first published the LED Throwie project, makers have invented dozens of ways to use them. In this project we show you how to adapt Throwies for extreme weather, add a simple “off” switch, and even immerse them in water and float them in the air.

**1. Make an LED Throwie.** Slip the coin cell battery between the LED’s leads so the battery’s positive side is touching the positive (longer) lead. The LED will light up. Wrap it once in electrical tape to insulate it. Then stick the magnet on the positive side and wrap it again. You’re done. (You can use 5mm LEDs for basic Throwies but you’ll want 10mm to make the Indestructible LED Lantern in Step 4.)

Now throw it onto your fridge, or truck, or any ferromagnetic metal surface, and you’ll see why they call it a Throwie.

## PARTS

For each LED Throwie:

- LED, 10mm #276-005
- Coin cell battery, CR2032 type #23-804
- Electrical tape #64-2373
- Disc magnet, rare-earth type, 1/2" to 1" diameter

Add for each Indestructible LED Lantern:

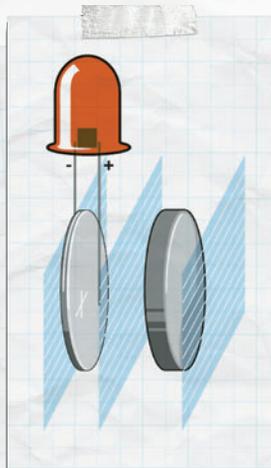
- PVC pipe cap, 1", slip-fit
- PVC pipe plug, 1", slip-fit
- Thread sealing tape
- Binder clip, 3/4" or smaller

Add for each LED Swimmie:

- Small toy fish, watertight or nearly so

Add for each LED Floatie:

- Helium balloon, 12", translucent



**2. Build a Throwie Bug.** Throwies naturally stick together magnetically. Chain them together into giant Throwie Bugs to really light things up!

**3. Hack your Throwie with an On-Off tab.** Cut 2 tabs of cardstock and sandwich the LED’s positive lead between them before you tape up the Throwie. One tab will stick to the tape; the other will slip in and out, making and breaking electrical contact. Now you can switch your Throwie on and off.

**4. Build an Indestructible LED Lantern.**

Ditch the magnet and slip your Throwie into a weatherproof capsule made from standard 1" PVC pipe fittings and Teflon tape. These simple, rugged, floating LED lanterns will glow for days, even in extreme weather. They’ve survived being submerged in water for a week, frozen, and laundered in the washing machine.

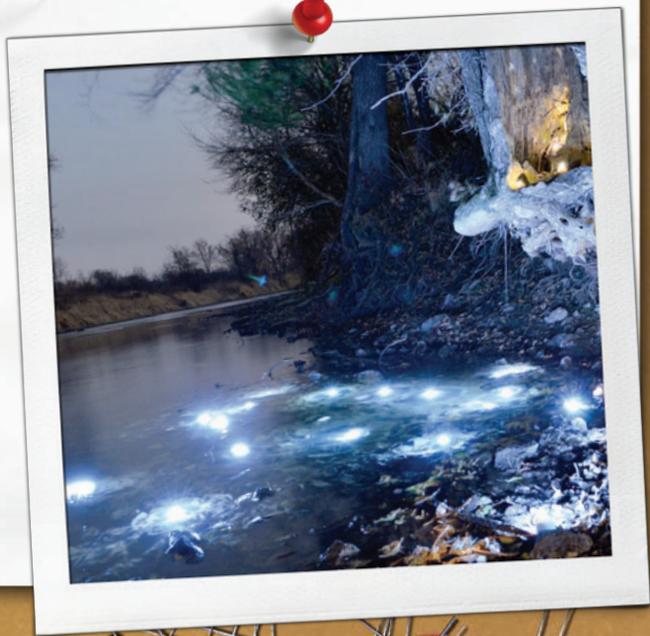
**5. Make LED Swimmies.** Slip your Throwies into little toy fish, seal them up, and set them free in a pond or pool to light up a party.



**6. Make LED Floaties.** Stuff your Throwies into helium balloons before inflating them. Then cover the ceiling with them, or tether them in bunches anywhere you want cool floating lights.

—Keith Hammond, MAKE Projects Editor

To see full build instructions, photos, and video, visit the project page for this build: [radioshackdiy.com/project-gallery/extreme-led-throwies](http://radioshackdiy.com/project-gallery/extreme-led-throwies)



**THIS PROJECT INCLUDES  
THESE  RadioShack® PARTS**



Coin cell batteries,  
CR2032 type



LEDs, 10mm



Electrical tape

To submit your own creation, explore other great creations, and get the hard-to-find parts you need, visit [RadioShack.com/DIY](http://RadioShack.com/DIY).



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# IT'S ALL ABOUT THE MAKERS

by Sherry Huss, Vice President, Maker Media

## **SURPRISE. CURIOSITY. FUN.**

**INSPIRATION.** MAKE magazine launched in 2005, full of eye-opening how-to projects and fascinating makers. It immediately became the catalyst for a tech-influenced DIY community that has come to be identified as the Maker Movement. Later that year, publisher Dale Dougherty asked, "Wouldn't it be cool if we could get all these makers together in one place to share what they make?"

The result was the first Maker Faire — a gathering of the maker tribe to show and tell, and inspire each other and anyone who'd pay attention. It was an aha moment for us. Today the Maker Movement continues to grow because every day, more people go from observer to participant — inspired by other makers, they begin making things themselves.

We've watched makers gravitate together to form intense creative communities that are innovating in technologies like personal 3D printing, hobby robotics, Arduino microcontrollers, and embedded computing. Makers are showing their work, collaborating online, and egging each other on.

We've seen makers branch outward, launching local makerspaces where any kind of making can be done by anyone — from electronics to CNC wood and metalworking to sewing and other traditional crafts. Makers are sharing expertise and high-tech tools, and cross-pollinating each other's ideas in the process.

And we've watched amateur makers go pro, leveraging shared knowledge and open technologies to manufacture products that can earn them a living. Makers are creating their own market ecosystem of products and services, and learning to push their pet projects out of the nest to fly in global commerce.

A few stories we love to tell:

### ► **SCHOOLTEACHER RICK**

**SCHERTLE** read MAKE, invented an air rocket launcher and wrote a how-to for the magazine, then came and showed it

off at Maker Faire. Compressed Air Rockets became an annual Faire favorite for thousands of kids, leading Rick to develop a kit (page 102) — and now thousands more kids have built their own rocket launchers.

### ► **HUSBAND AND WIFE JEFFREY MCGREW AND JILLIAN NORTHRUP**

bought one of the first ShopBot CNC routers, taught themselves to use it, and showed off their custom-cut furniture at the first Maker Faire in 2006. Their part-time CNC fascination blossomed into the successful architectural design-build studio called Because We Can. These days when they come to Maker Faire it's to give talks on how to become a professional maker.

### ► **INVENTOR STEVE HOEFER**

(page 36) read about the Arduino microcontroller, built an amazing Secret-Knock Gumball Machine and wrote a how-to for MAKE, then came and showed it off at Maker Faire, where thousands of kids (and adults) were delighted by it. He still gets letters from people who were inspired by his project to start making things. (You can build it on page 42.)

### ► **YOUNG ENTREPRENEUR LUKE**

**ISEMAN** (page 34) entered his homebrew electric motorcycle in Austin's Maker Faire and was instantly hooked. Since then he's developed the Garduino garden controller (page 61) and published a how-to in MAKE, leading to his successful Growerbot business. (He launched two other businesses while he was at it.)

► **BROOK DRUMM**'s wife bought him MAKE for Christmas, and when he saw a 3D printer on the cover he saved up and bought a kit. Building it with his 6-year-old son, he thought, "I could do better!" — then launched a record-setting Kickstarter campaign. At Maker Faire last year he showed off the portable, ultra-affordable Printbot Jr. (it won MAKE's

"At the heart of Maker Faire is this idea of play. We kind of get lost in it. People here have a love of what they're doing, and it comes across, and you walk away optimistic ... What people come away with is a feeling: they can do things."

— Dale Dougherty  
Founder, President,  
and CEO, Maker Media

"best value" award in our 2012 Ultimate Guide to 3D Printing special issue), inspiring thousands with his product and his story. Thousands more will build Printbot kits (page 91) and in turn, inspire others with the things they can make.

And that's what it's all about — makers inspiring makers by sharing their methods and projects, whether on the internet, in MAKE, or at Maker Faire, from the San Francisco Bay Area and New York City to Tokyo, Dublin, Singapore, Rome, London, Vancouver, and dozens of other cities around the world. Many are brand-new makers, fired up and ready to build their wildest dream or just solder their first circuit. Others are collaborating online and dreaming of attending a Maker Faire soon to meet up with the maker tribe they're feeling so strongly a part of. Many, like you, are reading MAKE and planning their next project right now.

It's in that spirit that we offer this special edition we're calling the Maker Projects Guide. In it you'll meet some of the makers who've inspired the Maker Movement. You'll build projects they've shared with the world — classics from the pages of MAKE and favorites from Maker Faire. And in our Maker Shed buyer's guide you'll find the kits, books, tools, and boards you need to get started building almost anything you can imagine.

So make something and show it off — online or at a Maker Faire, to your friends, your kids, the world. You never know who you'll inspire.



Tom Banwell

## FACE TO FACE



**Tom Banwell** is a self-taught man of many talents. He's a leatherworker, a caster/sculptor, and a tireless inventor of a vast selection of imaginative facemasks, many of which have been featured in films, television, and major magazines.

His most complex and extraordinary works are his "steampunk" gas masks, but he's also known for his delicate, laser-cut leather party masks and other uniquely shaped costume masks. Just to keep things interesting, he also makes rayguns.

His fantastic blog is a must-read for any costume designer or lover of steampunk. It's filled with well-written, step-by-step explanations and interesting tips and tricks. (Be sure to search for "A Steamier Raygun Holster," "Elevated Shoes," and "Modifying a Straw Hat.")

When asked why he gravitated to gas masks, Banwell says, "A gas mask, though

functional, dramatically alters the appearance of the wearer. This can be perceived by the viewer as terrifying — as one resembles a monster — or humorous — as one becomes a silly clown."

Banwell manages to combine these two feelings to create unforgettable masks that embody both fear and curiosity. The formal, antiqued leatherwork feels classic and foreboding, but he says the form of the masks — which can resemble a rhinoceros or an elephant — is "pure fantasy."

Banwell is constantly looking at the world around him and re-creating it in the most mad and pleasing manner possible. Looking through his fan photos, it's clear that when seemingly ordinary people don his masks, they unleash the more fantastic selves that lay dormant. —*Stacey Ransom*

[tombanwell.blogspot.com](http://tombanwell.blogspot.com)



"**MAKING** is at the center of my teaching."

Jack Chen uses **digital fabrication** technology to make **STEM** subjects come to life.

Jack Chen, a former manufacturing engineer and now a Math for America Fellow, is the instructor for the Instrumentation and Automation program, a three-year high school pre-engineering elective at the Sewanhaka (NY) Central School District's Career & Technical Education Center.

Jack says, "A great number of my students are very artistic. They naturally want to make things. What's so exciting about digital fabrication is that you can help students feed their desire to create while learning key STEM concepts."

*Jack Chen is one of hundreds of teachers around the country who've joined the 100kSchools.org community, a new, free resource created by ShopBot Tools to help teachers incorporate digital fabrication. "I'm looking forward to finding and sharing projects at 100kSchools, and letting all my teaching colleagues from science to art know about this resource." In this photo: Jack with the ShopBot Desktop he purchased for his classroom as part of ShopBot's "Digital Fab Tools for Schools" promotion that was launched with the support of Autodesk 123D Design.*

Jack also serves as the advisor for his high school district's robotics club, the Sewanhaka RoboPandas. In early March, the club competed at the 2013 New York City FIRST Tech Challenge Championship and won! The RoboPandas will now go on to compete at the World Championship in St. Louis in April.

Read more of Jack's story at [www.100kschools.org/blog/](http://www.100kschools.org/blog/) And if you're teaching, whether in traditional schools or other community settings, join us! The 100kSchools community can help you:

- Learn about many digital tools and technologies
- Find projects and curricula and share yours
- Connect with other teachers for mentorship and advice
- Find funding resources for your program



100k *Schools*.org

Education Resources for Digital Fabrication

100kSchools is a project of ShopBot Tools, Inc.

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## STICK CITY

When **Scott Weaver** first started gluing toothpicks together to create sculptures at the age of 8, little did he know he would later embark on a monumental 34-year journey toward completion of his epic *Rolling Through the Bay* sculpture.

The fourth-generation San Franciscan started *Rolling Through the Bay* in 1974 as a smaller piece that featured his signature ping-pong ball path running through it. He continued to work on the piece off and on until 2008, when he debuted it at the Sonoma County Fair, winning Best of Show. Utilizing a staggering 100,000 toothpicks, it stands 9 feet tall, 7 feet wide, and 30 inches deep, and features four different ping-pong ball routes that start at entry points atop the piece and travel past San Francisco landmarks. Weaver uses only Elmer's white glue.

The ping-pong ball routes are essential for a full appreciation of the details, which are so numerous and uniform in color that they risk being overlooked. The main tour starts at Coit Tower, wraps under a Rice-A-Roni cable car, through the Transamerica Pyramid, out to the Cliff House, down Lombard Street to Chinatown, back toward the Palace of Fine Arts, out around the windmill at Ocean Beach, across the Golden Gate Bridge, over Humphrey the humpback whale, behind Alcatraz, by the Maritime Museum, ending in the long-lost Fleishhacker Pool.

At Maker Faire Bay Area 2011, Weaver earned Editor's Choice blue ribbons and had perhaps one of the most photographed projects at the Faire. He is fueled by seeing people's reactions to his work, recognizing the madness in his method. "What kind of eccentric idiot would spend thousands of hours making a toothpick sculpture? That's me!"

—Goli Mohammadi

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

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*Shown here with optional stand, machine arm, LCD monitor, and other accessories.*

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## Maker Profile: JDS Labs

Open source design is a key element in the creation of the high-end DIY amplifiers and objective digital-to-analog converters (ODAC) produced at JDS Labs in Glen Carbon, Illinois. Founder and recent Missouri University of Science and Technology graduate John Seaber is using his PCNC 770 to streamline the manufacturing process and produce high-quality product for the image-conscious audiophile marketplace.



“For us, product appearance is just as important as sound quality. Some audiophiles will return a product that performs well because it's visually unpleasant. Cases we machine in-house with the PCNC 770 are of noticeably higher quality than those we had machined by outside shops, because we now have the ability to iterate design and manufacturing changes.”



Read the full story at: [www.tormach.com/jdslabs](http://www.tormach.com/jdslabs)



Tony DeRose

## FAST & FURIOUS FUSELAGE

Amid the sea of projects at Maker Faire Bay Area 2012, one shining standout was crafted by a team of five young makers, all under the age of 18 at the time. Welcome to the Viper, a full-motion flight simulator built into the fuselage of a Piper PA-28 plane, complete with 360° rotation on both the pitch and roll axes and a fully immersive flying environment inside. Not your typical after-school project.

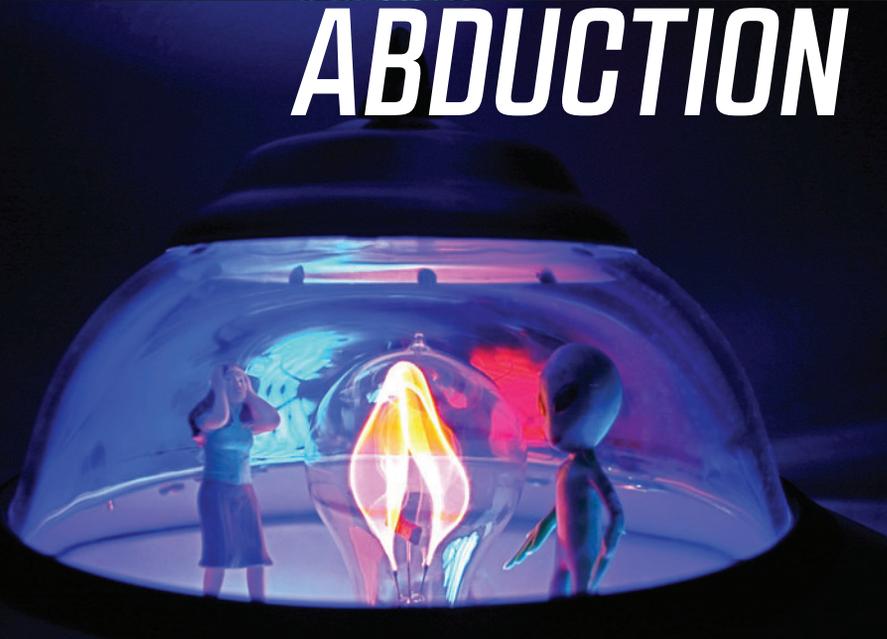
Team Viper is **John Boyer, Joseph DeRose, Sam DeRose, Sam Frank,** and **Alex Jacobson**, all members of the Young Makers club. Inspired by a simulator at the National Air and Space Museum, they set out to build a better version based on Battlestar Galactica's Viper spaceship.

Mission accomplished. Once the rider is harnessed in the Recaro racing seat with a full helmet, the plane door is put in place. Inside the cockpit, three 22" high-def screens display the game FlightGear, which you play as you fly. The armrests hold the joystick and thruster, while the custom instrument panel, dozens of buttons and LEDs, and sound system complete the full immersion experience. For control the team used five Arduinos, two iPhones, and one iPad, all networked together. As Sam D. says, "The only senses we don't control are taste and smell — that's for Maker Faire 2013." —Goli Mohammadi

[the-viper.org](http://the-viper.org)



## WARM GLOW OF ABDUCTION



Inspired by the flying saucers, rocket ships, and robots of 1950s sci-fi comic covers, **Jason Dietz** set out to create a little of that magic for his home. He decided to make lamps that depict a classic flying saucer shooting down a giant plasma ray and pulling up an unsuspecting victim into the ship. To get the desired effect, he knew he had to go big.

Dietz' UFO Lamps stand over 6 feet tall from base to saucer. The 2-foot-diameter flying saucer that crowns each lamp is a sturdy sandwich of parabolic aluminum heat dishes, Edison flame bulbs, and an acrylic disk. The saucer sits atop a giant hand-blown recycled-glass vase that holds 10 gallons of water.

CFL, LED, and halogen lights, in combination with a 110-volt air pump, nail the illusion, as the abduction victim, a lone cow, hovers and twirls helplessly above the grassy pasture from which it was plucked.

With its size, varied lighting, and constant motion, the lamp is beautiful and bizarre at once, not a sight easily overlooked. Dietz keeps one in his living room. "The soft glow of an alien abduction in progress in the corner of the room is quite the sight indeed," he says. "Staring at it for a while lets your imagination run wild — it puts me into that retro sci-fi world."

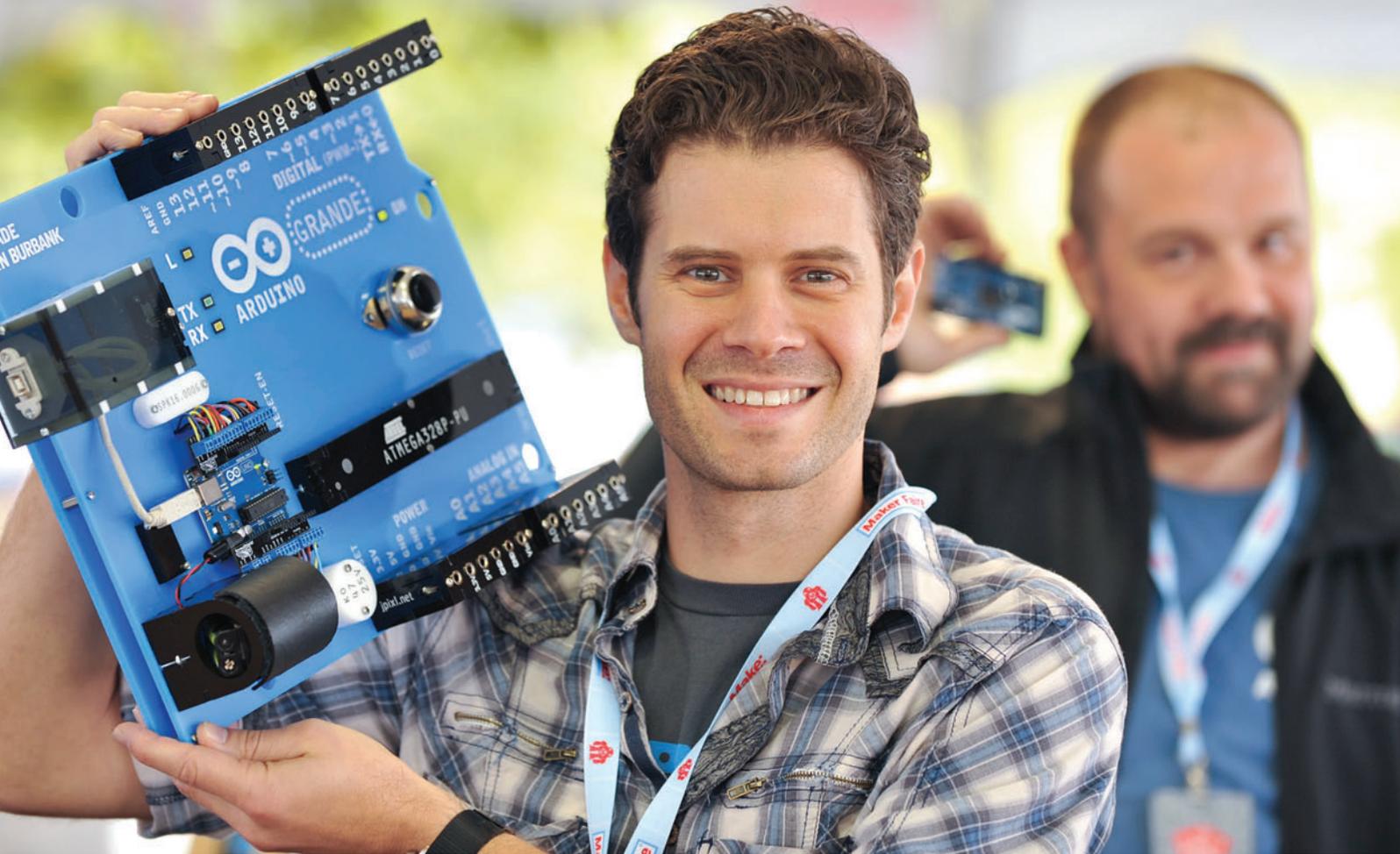
Like many makers, Dietz gains inspiration as much from seeing his visions come to life as from seeing others enjoying his creations. At Maker Faire Bay Area 2010, he displayed six of his UFO Lamps in a half circle at the back of Fiesta Hall, a dark environment that featured only projects that glow. Fairgoers were drawn in by the UFO beams, and thousands came closer for a good look.

"It looked like a small-scale alien invasion in the back of the hall," Dietz remembers. Apparently he wasn't the only one excited to see this fantasy made reality, as the lamps were in high demand.

"We all have the power to create anything we want to see," proclaims Dietz. "It just depends on how much you really want to see it happen."  
—Goli Mohammadi

[makezine.com/go/dietz](http://makezine.com/go/dietz)

John Edgar Park showcases his Arduino Grande at Maker Faire New York, while co-founder of the Arduino project, Massimo Banzi (background), holds the standard size.



## HONEY I SHRUNK THE MAKER

"Arduino is going to be really big at Maker Faire this year." As these words rang in MAKE editor John Edgar Park's ears, the thought occurred to him that he could make Arduino even bigger — literally.

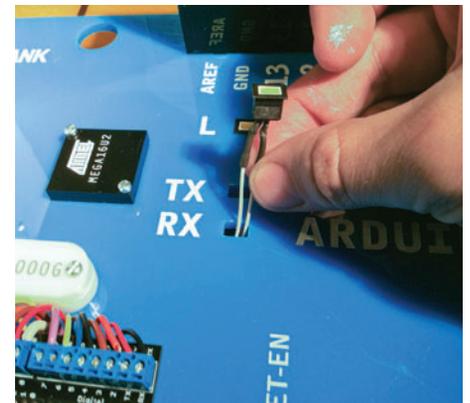
Using 3D modeling software, Park designed a giant version of the Arduino Uno microcontroller board. He then turned his delightful dream into reality by laser cutting, soldering, etching, and painting.

The result? Arduino Grande, a work-

ing microcontroller (thanks to a normal Uno mounted on the board) six times larger than life. In the top left corner (the location where a regular-sized Arduino declares its Italian origins), Arduino Grande proudly announces, "Made in Burbank" (Calif.). Park is pleased with his results: "The first time I hoisted it up on my shoulder like a boombox I was pretty darned psyched!"

—Laura Cochrane

[makezine.com/go/arduinogrande](http://makezine.com/go/arduinogrande)



Gregory Hayes (top); John Edgar Park (bottom)